

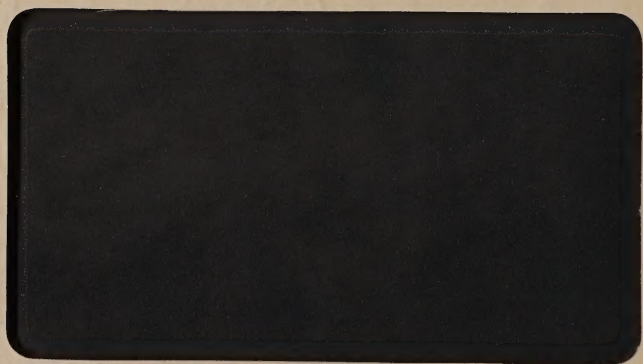


INSTRUCTION MANUAL

Type 1264-B Modulating Power Supply

B

GENERAL RADIO



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Type 1264-B Modulating Power Supply

B

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West Concord, Massachusetts, U.S.A. 01781
Form 1264-0110-B
January, 1969
ID-2311

Specifications

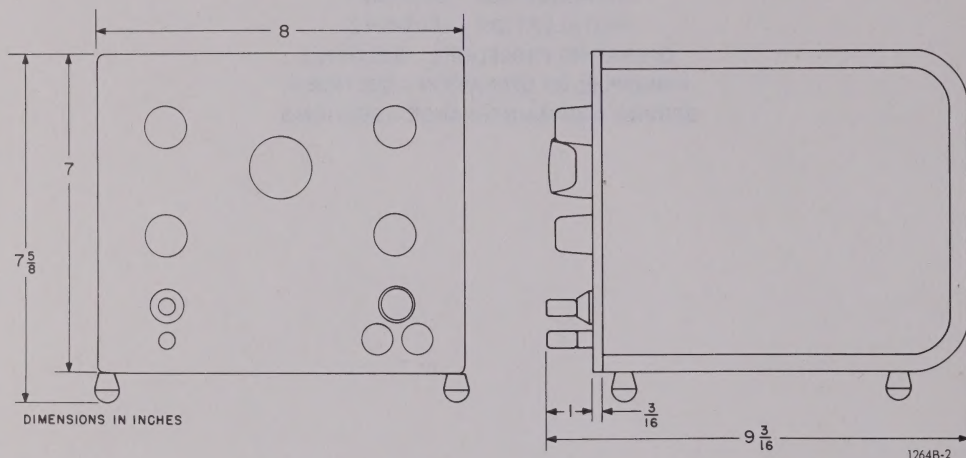


Figure 1-1. Approximate dimensions of the 1264 Modulating Power Supply.

NOTE: This instrument is equipped with our new snap-on knob for added convenience and safety. Refer to the Service Section for details.

REGULATED DC OUTPUT (Unmodulated)

Output: Adjustable 200 to 300 V; 50 mA, max.

Regulation: Output voltage at any rated load will change <0.5 V for 10-V line-voltage change. Dc output resistance, $<5 \Omega$ (typically 2Ω).

Ripple: <1 mV rms with B— grounded; <5 mV rms with B+ grounded.

HEATER POWER OUTPUT

Output: 6.5 V dc, regulated; adjustable, ± 0.3 V, 1 A, max.

Regulation: For 6.2- to 6.5-V output, voltage will change <5 mV for 10-V line-voltage change. Dc output resistance, <40 m Ω (typically 20 m Ω).

Ripple: <5 mV rms at full load.

MODULATED OUTPUT (Internally or Externally Driven)

Transition Times (10 to 90% points): $<1.5 \mu$ s when driving 300 pF across 15 k Ω or less.

Ramp-off: None.

SQUARE-WAVE OUTPUT (Internally Generated)

Amplitude: Adjustable, approx 160 to 210 V.

Frequency: Adjustable, 850 to 1150 Hz. Can be set to within 0.3 Hz of desired value.

Stability: Frequency will change $<0.1\%$ (typically 0.04%) for 10-V line-voltage change.

Duty Ratio: 0.5, adjustable $\pm 5\%$.

SQUARE-WAVE OUTPUT (Driven by External Sine-Wave Source)

Amplitude: Adjustable, approx 160 to 210 V.

Driver Requirement: 20 to 50 V rms, 20 Hz to 50 kHz.

PULSE OUTPUT (Driven by External Pulse Generator)

Amplitude: Adjustable, approx 160 to 210 V.

Duration (between half-amplitude points): 1.5 μ s to square waves, determined by external source.

Driver Requirement: $+20$ to $+50$ V, 100,000 pps, max.

Synchronization: Internal square-wave generator can be synchronized to a sine- or square-wave signal applied to the EXTERNAL INPUT/1 KHZ OUTPUT binding posts. Sync range is $\pm 1\%$ for a 5-V-rms, 1-kHz sine wave. A sync output of >2 V pk-pk behind 18 k Ω is delivered to these binding posts in internal 1-kHz square-wave mode of operation.

Power Required: 105 to 125 or 210 to 250 V, 50 to 400 Hz, 85 W.

Accessories Supplied: Power cord, connector plug, spare fuses.

Recommended Oscillators: 1361-A (450-1050 MHz); 1215-C (50-250 MHz); 1362 (220-920 MHz); 1363 (56-500 MHz); and 1218-B (900-2000 MHz). An adaptor cable is required for use with 1215-C.

Accessories Available: 1264-P1 Adaptor Cable to connect to 1215-C Oscillator; rack-adaptor sets for 19-in. relay-rack mounting, panel height 7 in.

Mounting: Convertible-Bench Cabinet.

Dimensions (width x height x depth): 8 x 7 x $9\frac{3}{4}$ in. (205 x 180 x 235 mm).

Weight: Net, 12 lb (5.5 kg); shipping, 15 lb (7 kg).

Introduction—Section 1

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1.1 PURPOSE.

The 1264 Modulating Power Supply produces 100% pulse and square-wave modulation of vhf and uhf oscillators, GR 1361, 1362, 1363, 1215, and 1218. In addition, it can be used as an adjustable regulated power supply for the oscillator plate and as a source of regulated heater power. The stable 1-kHz multivibrator provides square-wave modulation for use with sharply selective amplifiers following the signal detector.

1.2 DESCRIPTION.

1.2.1 GENERAL.

The 1264 comprises an electronically regulated, adjustable-output, high-voltage, dc supply; a decoupled, series-type power modulator driven by a Schmitt trigger circuit, and a 1-kHz multivibrator. A switch permits selection of cw, standby (only heaters

energized), 1-kHz square-wave modulated (internally generated), or externally modulated operation. Independent panel controls vary the regulated supply voltage for cw operation and the modulator amplitude for square-wave and pulse operation. Controls are also provided to adjust the frequency of the internal 1-kHz multivibrator and the duty ratio to produce a true square wave.

The input trigger circuit accepts single or multiple positive pulses, which are reproduced at the modulator output. It also accepts square waves at rates up to 100 kHz, or sine waves up to 50 kHz, from any 20-volt source and produces square waves at the modulator output. Recommended sources for external modulation are listed in Table 1-3. No adjustment of triggering is necessary. The stable 1-kHz multivibrator provides ideal square-wave modulation for use with sharply selective amplifiers following the signal detector.

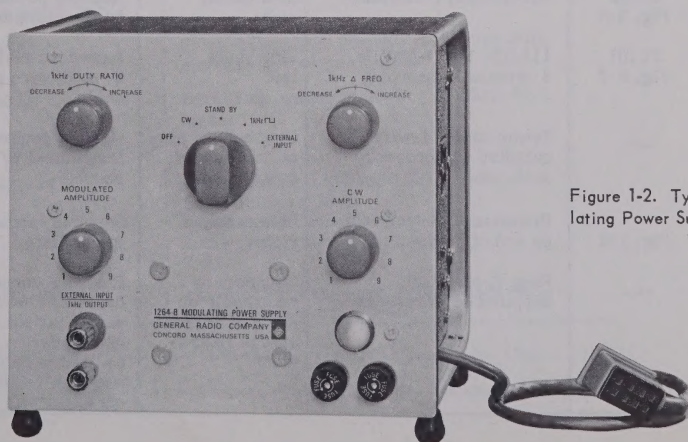


Figure 1-2. Type 1264 Modulating Power Supply.

Table 1-1

1264 CONTROLS AND CONNECTORS

Figure Reference	Name and Description	Location	Function
1 Fig. 1-3	<u>EXTERNAL INPUT</u> 1 kHz OUTPUT Binding posts, a pair	Front panel	Connects external driver for pulse modulation; delivers 1-kHz sync signal in internal 1-kHz mode.
2 Fig. 1-3	MODULATED AMPLITUDE Potentiometer, continuous rotary control	Front panel	Adjusts amplitude of square waves and pulses in 1 kHz $\square$ and EXTERNAL INPUT operation.
3 Fig. 1-3	1 kHz DUTY RATIO Potentiometer, continuous rotary control	Front panel	Controls duty ratio of internally generated square waves.
4 Fig. 1-3	Function Selector Rotary switch control	Front panel	Energizes instrument and selects mode of operation.
5 Fig. 1-3	1 kHz Δ FREQ Dual potentiometer, continuous rotary control	Front panel	Continuous coarse and fine adjustment of frequency of internally generated square waves.
6 Fig. 1-3	CW AMPLITUDE Potentiometer, continuous rotary control	Front panel	Controls amplitude of output voltage in CW operation.
7 Fig. 1-3	Pilot Light	Front panel	Indicates power supplied to the instrument when lamp glows.
8 Fig. 1-3	Fuse: 0.8 A for 115-V model, 0.4 A for 230-V model	Front panel	Overload protection at input.
R323 Fig. 5-6	300-V output Potentiometer, screw-driver adjustment.	Inside, rear of instrument	Adjusts maximum regulated dc output to 300 volts (CW mode).
R507 Fig. 5-6	6.5-V output Potentiometer, screw-driver adjustment	Inside, rear of instrument	Adjusts regulated heater power output voltage to 6.5-V dc.
S0101 Fig. 5-6	Receptacle, 5-terminal	Side panel, right	Accepts power plug from oscillator.
PL101 Fig. 5-7	115/230 V, 50-400 Hz, 3-terminal input plug	Side panel, left	Input terminals for 2- or 3-wire power cable.
---	Power cable, 3-wire, supplied as accessory	Connects to plug on left side of instrument	Used to connect instrument to power source.
Fig. 1-2	Receptacle, 8-terminal, on end of cable	Side panel, right	Supplies modulation to oscillator.
---	Plug, 8-terminal, supplied as accessory	Connects to receptacle on cable at right side of instrument	Provides connection between 1264 and oscillator for supply of modulation to oscillator (not required for use with recommended GR oscillators).

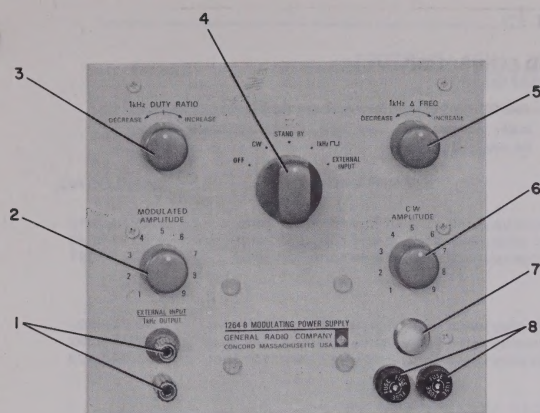


Figure 1-3. Panel controls and connectors on the 1264 Modulating Power Supply.

1.2.2 CONTROLS AND CONNECTORS.

Table 1-1 lists and describes the 1264 controls and connectors.

1.3 ACCESSORIES SUPPLIED.

Accessories supplied with the 1264 Modulating Power Supply are listed in Table 1-2.

1.4 ACCESSORIES AVAILABLE.

Table 1-3 lists and describes many GR instruments and accessories that are available for use with the 1264 Modulating Power Supply.

Table 1-2

1264 ACCESSORIES SUPPLIED

Catalog Number	Description	Quantity
4200-9622	Power Cable, 3-terminal	1
4220-5000	Connector Plug (Jones 8-pin type)	1
5330-0900	Fuse, 0.4 A (230-V model)	2
5330-1200	Fuse, 0.8 A (115-V model)	2
0480-3060	Hardware Set, for 1264/oscillator assembly (refer to Table 2-1 for list of parts)	1

Table 1-3

ACCESSORIES AVAILABLE FOR USE WITH 1264

Type	Description	Catalog/Part Number
OSCILLATORS:		
1215*	50-250 MHz range	1215-9703
1363	56-500 MHz range	1363-9701
1362	220-920 MHz range	1362-9701
1361	450-1050 MHz range	1361-9701
1218	900-2000 MHz range	1218-9702
SIGNAL SOURCES:		
1217**	Pulse Generator, positive and negative 40-mA pulses	1217-9703
1310	Oscillator, constant 20-V signal	1310-9701
RACK-ADAPTOR SETS:		
481-P416	For mounting 1264 and 1215, 1363, 1362, or 1361 oscillator combination in a relay rack (refer to Table 2-2)	0481-9646
482-P412	For mounting 1264 and 1218 oscillator in a relay rack	0482-9642

*A 1264-P1 Adaptor Cable (P/N 1264-9601) is required to connect the 1264 to a 1215 oscillator.

**A 1201 Power Supply is required for use with the 1217 Pulse Generator. Refer to the appendix for additional data.

TABLE 1-4

AVAILABLE PATCH CORDS AND ADAPTORS

Patch Cords and Adaptors.

NOTE: GR874 connectors are 50 Ω and are mechanically sexless; i.e., any two, although identical, can be plugged together.

TYPE NO.	DESCRIPTION	CATALOG NO.
274-NQ	Double-plug patch cord, in-line cord, 36" long	0274-9860
274-NQM	Double-plug patch cord, in-line cord, 24" long	0274-9896
274-NQS	Double-plug patch cord, in-line cord, 12" long	0274-9861
274-NP	Double-plug patch cord, right-angle cord, 36" long	0274-9880
274-NPM	Double-plug patch cord, right-angle cord, 24" long	0274-9892
274-NPS	Double-plug patch cord, right-angle cord, 12" long	0274-9852
274-NL	Shielded double-plug patch cord, 36" long	0274-9883
274-NLM	Shielded double-plug patch cord, 24" long	0274-9882
274-NLS	Shielded double-plug patch cord, 12" long	0274-9862
274-LLB	Single-plug patch cord, black, 36" long	0274-9468
274-LLR	Single-plug patch cord, red, 36" long	0274-9492
274-LMB	Single-plug patch cord, black, 24" long	0274-9847
274-LMR	Single-plug patch cord, red, 24" long	0274-9848
274-LSB	Single-plug patch cord, black, 12" long	0274-9849
274-LSR	Single-plug patch cord, red, 12" long	0274-9850
1560-P95	Adaptor cable, double-plug to telephone plug, 36"	1560-9695
874-R34	Coaxial patch cord, double plug to GR874, 36" long	0874-9692
874-R33	Coaxial patch cord, two plugs to GR874, 36" long	0874-9690
274-QBJ	Adaptor, shielded double plug to BNC jack	0274-9884
776-A	Patch cord, shielded double plug to BNC plug, 36" long	0776-9701
776-B	Patch cord, GR874 (right-angle) to BNC plug, 36" long	0776-9702
776-C	Patch cord, BNC plug to BNC plug, 36" long	0776-9703
776-D	GR874 to GR874, both right-angle, 36" long	0776-9704

Installation—Section 2

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2.1 GENERAL.

The Type 1264 Modulating Power Supply is intended primarily for use with vhf oscillators where square-wave or pulse modulation is desired. Installation requires interconnection with the associated oscillator, and with an external driving source if pulse modulation is required. In certain cases relay-rack mounting, attachment to a companion oscillator, or both may be desired.

2.2 LINE VOLTAGE REQUIREMENTS.

The nameplate adjacent to the power-input plug on the left side of the 1264 indicates whether the instrument is connected for 115-V or 230-V operation. The instrument is easily converted for either line input; starting with the primary of the power transformer (T 201) wired as shown in Figure 5-14, connect 1 to 3 and 2 to 4 for 115-V operation, or connect 2 to 3 for 230-V operation.

2.3 VENTILATION.

The 1264 Modulating Power Supply dissipates about 80 watts under maximum load conditions. Most of this heat must be carried away by air circulation over and through the unit. It is recommended that at least one rack unit (1-3/4 inches) of blank panel be provided both above and below the 1264 in permanent rack installations. In bench use, other equipment should not be stacked on top of the 1264.

2.4 CONNECTIONS TO ACCESSORY INSTRUMENTS.

2.4.1 EXTERNAL DRIVER.

The 1264 accepts square-waves at rates up to 100 kHz, or sinewaves up to 50 kHz, from any 20-V

source and produces square waves at the modulator output. The GR 1217 Unit Pulse Generator that provides 40-mA pulses, and the GR 1310 Oscillator that provides a constant 20-V signal, are suitable for this purpose. Figure 2-1 shows a typical set up using the 1264 with an external driver.

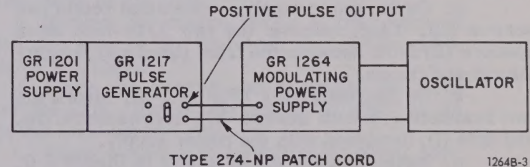


Figure 2-1. Typical pulse-modulation setup using the 1264 with an external driver.

2.4.2 OSCILLATORS.

The 1264 can be used with the GR oscillators listed in Table 1-3. Paragraph 2.5 describes the procedure for assembly of these oscillators with the 1264 for bench use. The electrical connections described in this paragraph also apply to the use of the 1264 and an oscillator as separate (not assembled) bench instruments.

2.5 ASSEMBLY FOR BENCH MOUNTING.

2.5.1 GENERAL.

The following paragraphs describe the recommended procedure, by oscillator type, for assembly of the 1264/oscillator combination for bench use. The 1264 is rigidly attached to the GR oscillator, using the Hardware Set listed in Table 2-1.

Table 2-1
HARDWARE FOR 1264/OSCILLATOR ASSEMBLY
(Part Number 0480-3060)

Quantity	Description	Fig. Ref.	Part Number
2	Bracket	F	0480-8070
4	Nut, hex, 10-32	I	5810-3300
2	Screw, 10-32, 1 1/4 in.	L	7080-3500
2	Screw, 10-32, 1/2 in.	-	7098-0160
4	Washer, lock, No. 10	H	8040-2400

2.5.2 ASSEMBLY WITH 1215 OSCILLATOR.

To assemble the power supply and oscillator for bench use, proceed as follows:

a. Remove the rubber feet (A, Figure 2-2) from the oscillator and power supply (inside feet only). Retain screws (B), lockwasher (K), and bracket (C).

b. On the power supply, remove and retain two screws (D). Then, remove the two 1/16-inch thick spacers (E) from between the front panel and the aluminum end frame.

c. On the oscillator (Figure 2-3), install the two brackets (F) with screws (G), lockwashers (H), and nuts (I), furnished with the power supply.

d. Install bracket (C) as shown in Figure 2-3, using one footscrew (B) and lockwasher (K) previously removed. The base of the oscillator is tapped to receive the screw.

e. Place the instruments side by side as shown in Figure 2-4.

f. Make all necessary electrical connections. Plug the power cord of the oscillator into the mating

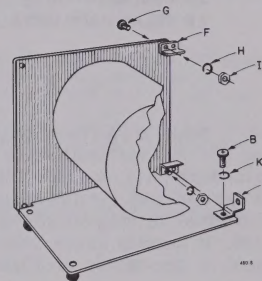


Figure 2-3.

receptacle on the Type 1264-P1 Adaptor Cable (Figure 2-4). Plug the five-terminal Jones connection on the adaptor cable into its mating receptacle on the right-hand side panel of the power supply. Attach the eight-terminal modulation connector on the power supply to its mating connector on the adaptor cable. Finally, insert the telephone plug on the adaptor cable into the MOD jack on the front of the oscillator.

g. The brackets (F) should slide into the space originally occupied by the spacers (E) on the right-

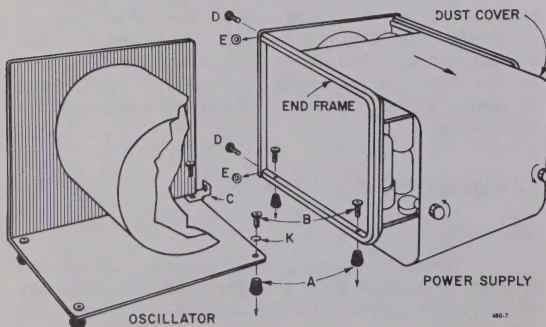


Figure 2-2.

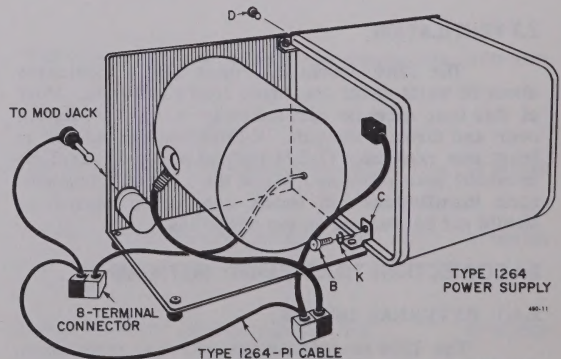


Figure 2-4.

hand side of the power supply. Reinstall the two front-panel screws (D).

h. Insert footscrew (B), previously removed from the oscillator, with lockwasher (K) into the hole in bracket (C) and screw into the matching tapped hole in the side panel of the power supply. Reinstall the dust cover on the power supply.

2.5.3 ASSEMBLY WITH 1218 OSCILLATOR.

To assemble the power supply and oscillator for bench use, proceed as follows:

a. Remove the rubber feet (A) from the oscillator and power supply (Figure 2-5). On the power supply, remove and retain the footscrews.

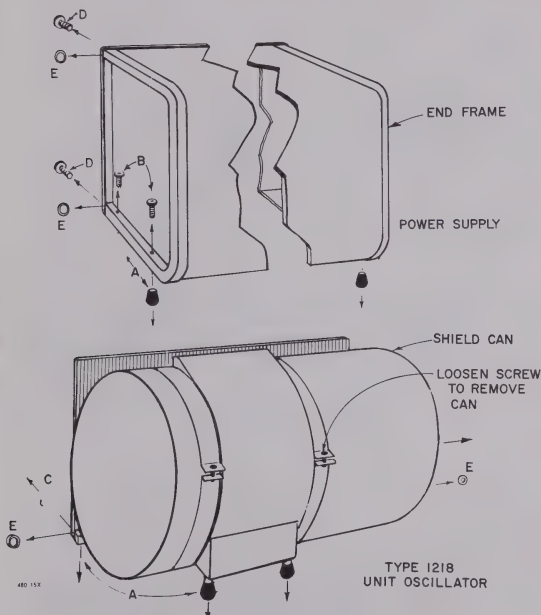


Figure 2-5.

b. Remove and retain the left-hand bracket screw (C) at the bottom of the oscillator. Remove and retain the two, right-hand side, end-frame screws (D) of the power supply. Remove the two 1/16-inch thick spacers (E) from the power supply.

c. Remove the left-hand shield can from the oscillator. To do this, loosen the screw that holds the metal band together, rock the can, and pull it off.

d. Remove the spacer bracket (J) from inside the oscillator and attach it to the threaded hole on the frame of the oscillator (Figure 2-6).

e. Attach the two brackets (F) to the left-hand side of the oscillator. Use screw (G), lockwasher (H), and nut (I), furnished with the power supply, at the top. Use screw (C), removed in step b, at the bottom.

f. Remount the shield can on the oscillator. The procedure is a reverse of step c.

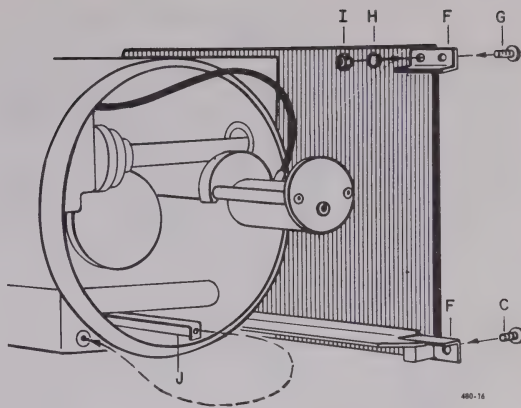


Figure 2-6.

g. Connect the five-terminal plug on the right-hand side of the oscillator to its mating receptacle on the left-hand side of the power supply.

h. Place the power supply at the left of the oscillator and push the instruments together, so that the brackets attached in step e slide into the space between the panel and the end frame of the power supply. Reinstall the two end-frame screws (D) on the right-hand side of the power supply (Figure 2-7).

i. Connect the five-pin plug on the left-hand side of the oscillator to its receptacle on the right-hand side panel of the 1264.

j. Remove the dummy socket at the bottom of the 1218 and plug in the eight-pin modulation cable attached to the 1264.

k. Store the dummy socket behind the front panel of the 1218. It will nest above the shelf to the right of the level-control shaft.

l. Attach mounting bracket (J) to the power supply using a foot-screw (B) passed through the bracket.

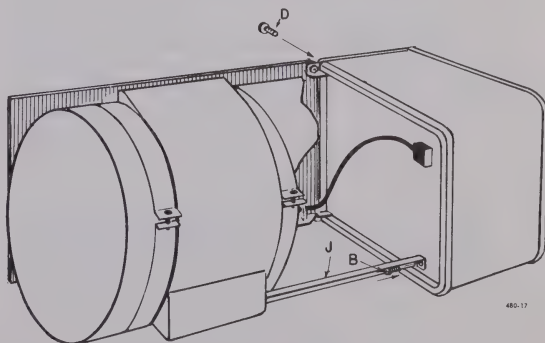


Figure 2-7.

2.5.4 ASSEMBLY WITH 1361, 1362, AND 1363.

To assemble the power supply and oscillator for bench use, proceed as follows:

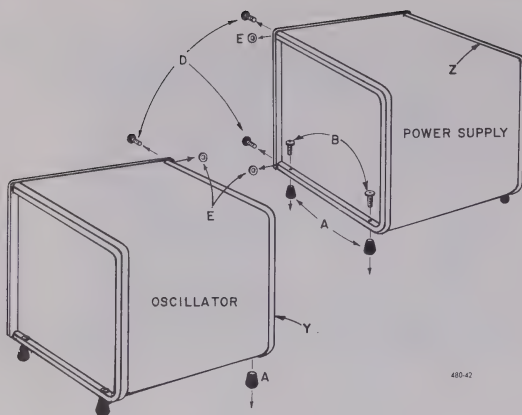


Figure 2-8.

a. Remove both rubber feet (A) at the right-hand side of the power supply and the left-hand side of the oscillator (see Figure 2-8).

b. Remove the two end-frame attaching screws (D) at the right-hand edge of the power supply and the left-hand edge of the oscillator.

c. Remove the spacers (E) between the panels and the end frames.

d. Insert brackets (F) in place of the washers on the power supply (see Figure 2-9). Reinstall panel screws (D).

e. Place the power supply on its left-hand side, close to the oscillator, and attach the 5-pin oscillator plug to the connector on the right-hand side of the power supply.

f. Remove the dummy socket from the plug on the left-hand side of the oscillator. Plug the eight-terminal connector of the attached modulation patch cord on the power supply to the connector on the oscillator (Figure 2-10).

g. Position the oscillator above the power supply and lower it so that both instruments slide together, with the exposed ends of brackets (F) entering the spacer slots behind the front panel of the oscillator.

NOTE

Form the cord into a flat coil between the side walls of the instruments as they are joined together. Figure 2-10 shows the cord position after assembly.

h. Reinstall front-panel screws (D) in the oscillator.

i. Remove the dust cover from the rear of the oscillator. Also remove the dust cover from the power supply.

j. Insert two screws (L) (supplied) through the top and bottom clearance holes in the side panel of the oscillator and thread them into the matching tapped holes in the joining walls of the power supply (see Figure 2-10).

k. Set the assembly on its feet, tighten all screws securely, and reinstall dust covers on both instruments.

2.6 RELAY-RACK INSTALLATION.

Instructions for rack-mounting the oscillator and power supply are included with the rack-mounting adaptor sets.

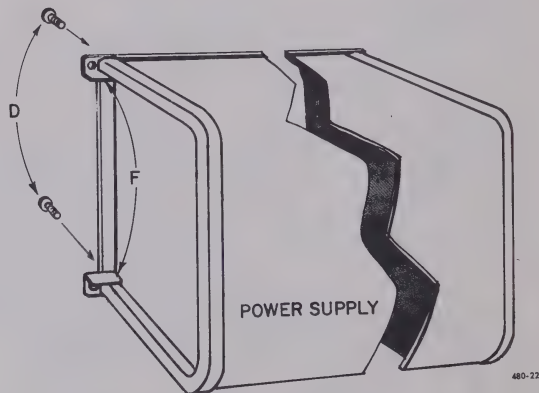


Figure 2-9.

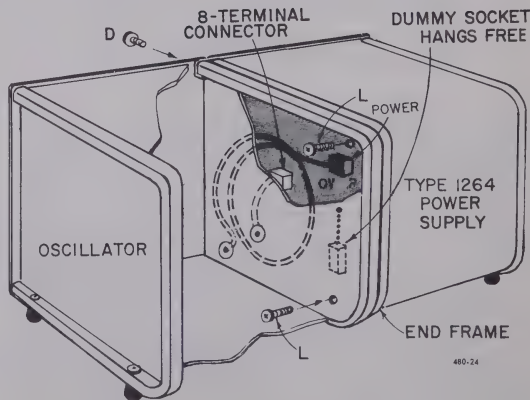


Figure 2-10.

Operation—Section 3

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3.3 USE WITH GR OSCILLATORS	3-2

3.1 PRELIMINARY CONSIDERATIONS.

Before operating the instrument, make sure that the line voltage and frequency are as specified in the nameplate adjacent to the power input connector. Also make sure that the ventilating holes are not obstructed.

3.2 OPERATING PROCEDURE.

3.2.1 INITIAL SETTINGS.

To apply power to the instrument, turn the function switch (the five-position switch in the upper center of the panel) from OFF to the desired mode of operation.

When the function switch is at STAND BY, the heater and plate voltages are applied to the oscillator, but the cathode circuit is biased to cut off rf output from the oscillator.

3.2.2 MAXIMUM OUTPUT SETTINGS.

The 1264 will drive the various oscillators close to the maximum allowable output when the CW AMPLITUDE or MODULATED AMPLITUDE control is set fully clockwise. For reduced frequency drift and longer tube life, the AMPLITUDE control should be backed off somewhat from its clockwise limit. For pulsing of a 1218, 1361, or 1362 oscillator with a duty cycle greater than 0.5, reduce the MODULATED AMPLITUDE setting to prevent excessive tube dissipation.

3.2.3 CW OPERATION.

In cw operation the oscillator B+ voltage is adjusted over the range of 200 to 300 volts by means of the CW AMPLITUDE control. Turning this control clockwise increases oscillator output.

3.2.4 1-kHz SQUARE-WAVE OPERATION.

When the function switch is at 1 kHz $\square$, the modulator delivers a negative pulse of approximately 0.5 duty ratio to the cathode of the oscillator. The frequency is adjustable from 850 to 1150 Hz by means of the 1 kHz Δ FREQ control. The duty ratio is adjustable over a range of $\pm 5\%$ by means of the 1 kHz DUTY RATIO control. The amplitude is adjustable from approximately 160 to 210 volts by means of the MODULATED AMPLITUDE control. The pulse amplitude is entirely independent of the setting of the CW AMPLITUDE control.

In this mode of operation, a sample of the 1-kHz signal is brought out to the EXTERNAL INPUT/1kHz OUTPUT binding posts for use in synchronizing oscilloscope sweeps. Conversely, a synchronizing signal from an external oscillator may be injected here.

A dual potentiometer makes possible both coarse and fine setting of the 1-kHz frequency with a single knob. To set to the exact center of an amplifier passband, tune the frequency slightly beyond the point of maximum response (coarse setting), then back up to find the exact peak; this brings the fine adjustment into operation over an arc of approximately 40° for a frequency adjustment of about 7 Hz at a center frequency of 1 kHz.

3.2.5 EXTERNAL OPERATION.

When the function switch is at EXTERNAL INPUT, the modulator will deliver an output only if a suitable input (pulse, square wave, or sinewave) is applied to the EXTERNAL INPUT terminals. This position is most useful when short pulses are required. A positive input pulse of 20-volt peak amplitude is required. Suitable pulses can be obtained from the GR 1217 Unit Pulse Generator. The video output pulse is

of approximately the same duration as the input pulse, but rise and decay times depend on the nature of the load offered by the oscillator. Pulses with duty ratios up to 0.5 (square-waves) may be generated without special precautions. The 1264 will accept and deliver pulses of higher duty ratios at all but the highest repetition rates. If a duty ratio greater than 0.5 is used to modulate the 1218, 1361, or 1362 oscillator, the MODULATED AMPLITUDE control should be backed off in a counterclockwise direction to prevent excessive oscillator tube dissipation. When these oscillators are modulated at a duty ratio of 0.75 the MODULATED AMPLITUDE control should be set at 5 or lower. The 1215 and 1363 oscillators cannot be overloaded by any setting of the 1264 controls.

Where square waves of approximately 0.5 duty ratio are required at frequencies outside the 850-to

1150-Hz internal range, it is possible to generate them in the 1264 by the use of sinewaves of at least 20 volts, rms, applied to the EXTERNAL INPUT terminals. The frequency range for such sinewave drive is 20 Hz to 50 kHz. Square-wave drive is preferable if the exact duty ratio is important.

3.3 USE WITH GR OSCILLATORS.

The character of the modulated rf output obtained from the various oscillators that can be used with the 1264 depends on the type of oscillator and the frequency to which it is tuned. For specific operating characteristics, refer to the instructions furnished with the GR oscillators.

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4.1 GENERAL.

The 1264 Modulating Power supply is composed of five basic circuits:

1. highly regulated dc power supply, adjustable from 200 to 300 volts,
2. regulated 6.5-V dc heater power supply,
3. modulator,
4. Schmitt trigger circuit to drive the modulator,
5. 1-kHz multivibrator to drive the trigger circuit for square-wave output at a frequency that is determined by the internal generator.

Refer to the block diagram, Figure 5-9 and the schematic diagram, Figure 5-14. For location of the parts mentioned in the following paragraph, refer to Figures 5-5, 5-6, and 5-7.

4.2 POWER SUPPLIES.

4.2.1 REGULATED POWER SUPPLY.

The regulated power supply uses a full-wave voltage-doubler circuit with silicon diode rectifiers and capacitance filtering. R201 limits the peak rectifier current to a safe value. The regulator is of the series-losser type, controlled by comparison of a portion of the output voltage with a reference voltage obtained from gas tube V303. The comparison is performed in a differential cathode-coupled amplifier (V304), and the difference is further amplified by V301. The pentode section, V301B, is cascode connected to V304B of the comparator to provide a high-gain amplifier. Triode V301A is a cathode follower which couples the output of the cascode amplifier to the grid of the series-losser tube, V302. The series tube is pentode connected, with a 100-volt screen supply provided by a separate half-wave rectifier and filter.

Adjustment of R402 (in cw operation) or R401 (for modulated operation) varies the proportion of the output applied to the comparison circuit, and thereby controls the output voltage. The output voltage can be controlled over the range from 200 to 300 volts with the function switch (S401) set at CW, and over the range 200 to 250 volts for all other operating positions.

4.2.2 REGULATED HEATER SUPPLY.

A bridge rectifier provides the input voltage for the series regulator. The output voltage, through a voltage divider comprised of R506, R507, and R508, is compared with a Zener reference diode (CR503) by transistor Q505. The amplifier error voltage is applied to the Darlington-pair (Q501 and Q502) series transistors to provide constant output voltage. Resistor R501 and diode CR501 serve as a current limiter, and R503 and CR502 as a start-up circuit.

4.2.3 REGULATED 1-kHz MULTIVIBRATOR SUPPLY.

The dc supply voltage that feeds the adjustable electronic regulator is also used to supply power to the 1-kHz multivibrator (V404) via a Zener diode CR401.

4.2.4 UNREGULATED TRIGGER-CIRCUIT SUPPLY.

A separate unregulated 300-volt power supply, using silicon diode rectifiers in a voltage-doubler circuit with capacitance filtering, provides power to operate the negative output of the regulated supply. The resulting bus is referred to as COMMON on the schematic diagram (Figure 5-14). This arrangement permits dc coupling of the trigger to the modulator.

4.2.5 POWER SUPPLY GROUND.

The COMMON bus is not internally grounded to the instrument case. Either the COMMON bus or the positive regulated output bus may be grounded depend-

ing on the requirements of the oscillator to be modulated. The necessary grounding is accomplished automatically when the eight-connector cable is plugged into the associated oscillator. This is true whether the connection is direct (as in the case of the 1218, 1361, 1362 or 1363 oscillators) or by way of an adaptor cable (as in the case of the 1215). The panel of the associated oscillator is also grounded automatically to the case of the 1264 Modulating Power Supply when the units are interconnected.

4.3 MODULATOR.

Tubes V402 and V403 constitute the modulator, which delivers a negative pulse to the cathode of the oscillator, thereby turning the oscillator on. The output pulse amplitude can be adjusted from approximately 160 to 210 volts by means of R401, which controls the supply voltage. In the absence of an input signal, V403 is biased beyond cutoff and its plate and screen are at the supply potential. When the trigger circuit responds to an incoming signal, the grid of V403 rises to +5 volts, drawing current through R406, and causing heavy plate current to flow through the load provided by the oscillator to be modulated. V401A provides a fixed supply voltage for R406, so that operation of the trigger circuit is unaffected by adjustment of the modulator output amplitude. C402 permits additional screen and plate current to flow briefly while charging the load capacitance, thereby providing a short rise time for the modulating pulse. Tube V402 is inactive during the rise of the pulse because it is cut off by the bias resulting from V403 plate current flowing through R408. When the input signal ends and V403 is again cut off, V402 conducts and discharges the load capacitance rapidly. This action is enhanced by a pulse of screen current supplied by C401 which was charged up to the supply voltage during the time that V403 was turned on. V401B is diode-connected to permit the screen voltage on V402 to rise above the supply potential until C401 is discharged by the resultant screen current.

4.4 SCHMITT TRIGGER CIRCUIT.

The Schmitt trigger circuit accepts square waves from the internal multivibrator, or pulses, square waves, or sine waves from an external driver, and converts them to suitable waveforms to drive the modulator. V405 is connected as a bistable trigger, with one coupling provided by the common cathode resistor R426, and the other by plate-to-grid coupling resistors R427 (shunted by C406 to provide fast switching) and R428. The plate of V405B is directly coupled to the grid of modulator tube V403, thereby avoiding

any tendency for droop in the output pulse even at long pulse durations.

The input bias on the grid of V405 is set by R421 and R420 or R438 at a value that ensures triggering by a positive input pulse of 20 volts peak amplitude. Diode CR401 clamps the negative peak of the driving signal on the grid side of C405 to the predetermined bias voltage. This prevents C405 from charging up in such a way as to permit premature cutoff of the trigger tube V405A under conditions of sine wave, square wave, or long repetitive pulse input signals.

4.5 1-kHz MULTIVIBRATOR

Tube V404 is a conventional ac-coupled multivibrator with the grids returned to B+ through timing resistors R412, R413, R414, and R415. The use of large plate resistors permits thorough bottoming of the tube plates. The output frequency is virtually independent of tube characteristics and of line voltage. Output is obtained from the cathode of V404B across R417. The waveform at this point is more nearly square than that at the grid or plate of either tube section. Resistor R413 permits some adjustment of the duty ratio of the square wave, but has negligible effects on frequency since the time constant of one of the coupling circuits is increased by the same amount as that of the other coupling is decreased. R412 permits adjustment of the square-wave frequency between 850 and 1150 Hz by effectively varying the potential to which the timing circuits are returned.

This control (R412) is a dual potentiometer with a single shaft. The front section of the potentiometer (R412B) is the fine control and its wiper arm is connected directly to the shaft. The rear section is the coarse control (R412A) and its wiper arm is driven by the same shaft, but with backlash built into the connection. With this type of control, fine adjustment of the frequency can be made over about 40° of knob rotation without changing the coarse adjustment. To operate, turn the knob to overshoot the desired position slightly, and then turn the knob in the opposite direction for fine adjustment.

A special compensating network consisting of R434, R437 and C407 is employed to introduce variations of the unregulated -300 V supply voltage to the multivibrator B+ grid return. The degree of compensation is adjusted by setting R437 to match the particular tube in use. Since most of the change to be compensated is due to tube heater effects, C407 introduces a time delay in the compensating circuit that matches the thermal time constant of the tube. R435 provides a small amount of compensation, without time delay, to correct for residual B+ variations due to the finite impedance of Zener diode CR401.

Service and Maintenance—Section 5

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5.1 WARRANTY.

We warrant that each new instrument manufactured and sold by us is free from defects in material and workmanship, and that, properly used, it will perform in full accordance with applicable specifications for a period of two years after original shipment. Any instrument or component that is found within the two-year period not to meet these standards after examination by our factory, District Office, or authorized repair agency personnel will be repaired or, at our option, replaced without charge, except for tubes or batteries that have given normal service.

5.2 SERVICE.

The two-year warranty stated above attests the quality of materials and workmanship in our products. When difficulties do occur, our service engineers will assist in any way possible. If the difficulty cannot be eliminated by use of the following service instructions, please write or phone our Service Department giving full information of the trouble and of steps taken to remedy it. Be sure to mention the type and serial numbers of the instrument.

Before returning an instrument to General Radio for service, please write to our Service Department or nearest District Office, requesting a "Returned Material Tag." Use of this tag will ensure proper handling and identification. For instruments not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay.

5.3 REMOVAL OF COVER.

WARNING

Always disconnect power before opening the instrument case. The total power-supply potential is 725 volts.

To remove the dust cover, loosen the two thumb screws on the rear of the instrument and withdraw the cover.

5.4 TUBE REPLACEMENT.

Care should be exercised in replacing tubes to be sure that the correct tube type is inserted into each socket. Particular attention is called to the fact that one type 5963 dual triode is used for the 1-kHz multivibrator (V404) at the top center on the modulator circuit board, whereas all other dual triode tubes are type 5965. Interchange of a 5963 for a 5965, or vice versa, may significantly degrade the performance of the instrument.

Replacement of the 1-kHz multivibrator (V404) may require readjustment of R437 if the best frequency stability is required in the face of varying line voltage. Set the function-selector switch to 1 kHz and allow at least a ten-minute warmup of the instrument at 115-V line voltage before attempting the adjustment. Then proceed as follows:

- a. Set R437 fully clockwise.
- b. Set the 1 kHz Δ FREQ control to produce an output frequency of 1,010 kHz as measured by a counter or frequency meter connected to the EXTERNAL INPUT/1kHz OUTPUT binding posts.
- c. Observe the change in frequency as the line voltage is varied from 105 to 115 V and from 115 to 125 V, watching as it stabilizes for one minute after changing the voltage.
- d. Adjust R437 counterclockwise until the final frequency is the same as the initial frequency. As R437 is turned to increase the compensation, some resetting of the 1 kHz Δ FREQ will be required to maintain the 1,010-kHz output frequency. Since the optimum setting of R437 may be different for the 105-to 115-V and the 115-V to 125-V

steps, some compromise will usually be required. After adjustment, variation over a one-minute period for either increasing or decreasing 10-volt steps should not exceed 1 Hz.

5.5 OUTPUT VOLTAGE ADJUSTMENT.

5.5.1 REGULATED POWER SUPPLY.

A single adjustment, potentiometer R323, is provided to set the output voltage to the desired level. This potentiometer is mounted on a bracket and it is easily accessible from the rear of the instrument when the dust cover is removed (see Figure 5-6).

Readjustment is usually unnecessary except after replacement of V303 or V304. Adjust R323 for the desired voltage (within $\pm 1\%$) at the output terminals.

5.5.2 REGULATED HEATER SUPPLY.

A single adjustment, R507, is provided to set the heater supply voltage. This potentiometer is mounted on the small etched-circuit board mounted on the inside of the side panel (see Figure 5-6). This adjustment is accessible from the rear of the instrument when the dust cover is removed.

Readjustment is usually unnecessary except after replacement of CR503. Adjust R507 for 6.5 V $\pm 1\%$ at the output terminals. This voltage setting

allows for a 0.2-V average drop in cables and feed chokes so that the voltage will be 6.3 V at the oscillator tube.

5.6 MINIMUM PERFORMANCE STANDARDS.

The following procedure for checking the 1264 specifications is recommended for incoming inspection or periodic operational testing.

5.6.1 EQUIPMENT REQUIRED.

The equipment specifications given in Table 5-1 are minimum requirements and equivalent equipment may be substituted for the models recommended.

5.6.2 TEST PROCEDURES.

GENERAL. Connect the autotransformer to the 1264 and allow the 1264 to warm up for approximately thirty minutes before performing any of the following tests.

REGULATED DC OUTPUT. To test the regulated output of the 1264 for regulation and ripple, use the basic circuit shown in Figure 5-1, and proceed as follows:

- a. Connect the load circuit (leads x and y, Figure 5-1) to the 8-terminal receptacle

Table 5-1
TEST EQUIPMENT

Type	Requirements	Model Recommended
Adjustable autotransformer	Source of ac power, variable from 0 to 125 V	Metered Variac® GR W5MT3W
Vacuum-tube voltmeter	Range: 1 to 10 mV. Accuracy: $\pm 3\%$	Ballantine #314
Differential voltmeter	Range: 0 to 350 V Accuracy: $\pm 0.02\%$	Fluke #825-A
Oscilloscope	Bandwidth: dc to 500 kHz	Tektronix Type 503 or 541
Frequency measuring counter	Frequency: 1 kHz Accuracy: 0.1%	GR 1191 Counter
Resistor	6 k Ω $\pm 10\%$, 20 W	-
Resistor	6.5 Ω $\pm 5\%$, 10 W	-
Resistor	15 k Ω $\pm 10\%$, 10 W	-
Capacitor	300 pF, 500 Vdc	-

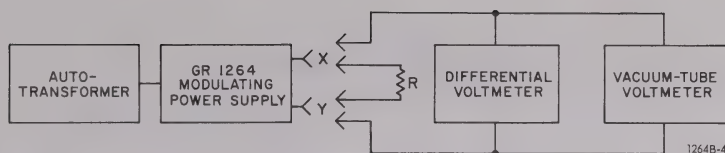


Figure 5-1. Circuit for testing regulation and ripple of the regulated 200-to 300-V dc and 6.5-V heater output of the 1264 Modulating Power Supply. Note separate leads for load resistor (R).

(S0102) on the 1264, as shown in Table 5-2. Use the 6 k Ω resistor (R in the circuit) for the load; remove the resistor for no-load.

- b. On the 1264, set the function switch to CW and the CW AMPLITUDE control for a 300-V reading on the differential voltmeter. If the output voltage cannot be set at 300 V using the CW AMPLITUDE control, readjust the output as described in paragraph 5.5.1.
- c. Follow the test procedure indicated in Table 5-2.

HEATER POWER OUTPUT. To test the heater power output of the 1264 for regulation and ripple, use the basic circuit shown in Figure 5-1, and proceed as follows:

- a. Connect the load circuit (leads x and y, Figure 5-1) to the 5-terminal receptacle (S0101 located on the right-hand side of the 1264), as shown in Table 5-3. Use the 6.5 Ω resistor (R in the circuit) for the load; remove the resistor for no-load.

NOTE

The resistor leads must be separate from the meter leads in order to avoid erroneous readings that may result from voltage drops in the leads.

- b. Set the 1264 function switch to CW and measure the output voltage with the differential voltmeter. If the reading is not within 6.5 ± 0.1 V, readjust the output as described in paragraph 5.5.2.
- c. Follow the test procedure indicated in Table 5-3.

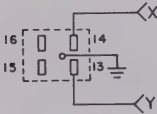
MODULATED OUTPUT. To test the modulated output (internally driven) of the 1264, use the basic circuit shown in Figure 5-2, and proceed as follows:

- a. Connect the load circuit (leads x and y, Figure 5-2) to the 8-terminal receptacle (S0102) on the 1264, as shown in Table 5-4. Use the 15 k Ω resistor and the 300 pF ca-

Table 5-2
1264 REGULATION AND RIPPLE TESTS
(200-to 300-V Output)

1264 (S0102) Connections (Refer to Fig. 5-1)	Load (R)	Autotransformer Setting	Regulation (Diff. Voltmeter)	Ripple (VTVM)
B+ grounded 	6 k Ω	115 V	300 V	<5 mV at all measurements
	$\infty \Omega$	115 V	300 ± 0.25 V	
	6 k Ω	105 V	300 ± 0.5 V	
Note connection between 1 and 3	6 k Ω	125 V	300 ± 0.5 V	
B- grounded 	6 k Ω	115 V	-	not to exceed 1 mV at all measurements
	6 k Ω	105 V	-	
Note connection between 2 and 3	6 k Ω	125 V	-	

Table 5-3
1264 REGULATION AND RIPPLE TESTS
(6.5-V Heater Output)

1264 (S0101) Connections (Refer to Fig. 5-1)	Load (R)	Autotransformer Setting	Regulation (Diff. Voltmeter)	Ripple (VTVM)
	6.5 Ω	115 V	6.5 $\pm$ 0.3 V (record as reference A)	<5 mV at all measurements
	$\infty \Omega$	115 V	A $\pm$ 40 mV	
	6.5 Ω	105 V	<5 mV from A	
	6.5 Ω	125 V	<5 mV from A	

pacitor (RC parallel combination in the circuit) for the load.

- Set the 1264 function switch to 1 kHz $\square$.
- Follow the test procedure indicated in Table 5-4.

1-kHz OUTPUT STABILITY. The frequency stability of the 1-kHz output of the 1264 can be tested as follows:

- Connect the autotransformer to the 1264 and a frequency measuring counter to the 1 kHz OUTPUT binding posts on the 1264.
- Set the 1264 function switch to 1 kHz $\square$ and the autotransformer to 115 V.
- Record the frequency reading on the counter.
- Set the autotransformer to 105 V, and then to 125 V. Record the counter reading at each setting.
- Compare the last two counter readings with the first; they should vary by less than 0.1%.

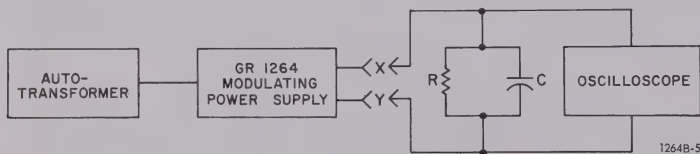


Figure 5-2. Circuit for testing modulated output of the 1264 Modulating Power Supply.

Table 5-4
1264 MODULATED OUTPUT TESTS

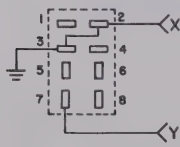
1264 (S0102) Connections (Refer to Fig. 5-2)	Instrument Settings		Measurements (Oscilloscope)
	1264	Autotransformer	
B- grounded  Note connection between 2 and 3	-	115 V	Transition time (10% to 90% points): < 1.5 μ s
	-	115 V	Ramp-off: none
	Vary MODULATED AMPLITUDE from fully ccw to fully cw	115 V	Amplitude: 160 to 200 V approximate

Table 5-5
LOCALIZING TROUBLE IN THE SYSTEM

Symptom	Faulty Unit
No oscillator output in EXT, but normal in 1 kHz $\square$ or CW.	External Driver
CW oscillator output low or zero after replacing the 1264 with another 1264.	Oscillator
Oscillator output low or zero using 1264, but normal when replaced with another 1264.	1264
No oscillator output in EXT (using an external driver) or 1 kHz $\square$, but normal in CW.	1264 (modulator or Schmitt circuit)
No oscillator output in 1 kHz $\square$, but normal in EXT (using an external driver) and CW.	1264 (1-kHz multivibrator)

5.7 TROUBLE ANALYSIS.

5.7.1 GENERAL.

Normally, the 1264 is only one unit in a two- or three-unit system that consists of an oscillator, a 1264, and sometimes an external driver. Most system failures manifest themselves in the oscillator output, but the 1264 or the external driver (if one is used), as well as the oscillator itself, may be the cause of the trouble. Therefore, if a problem does occur, the

first step in troubleshooting is to localize the fault to a single unit.

5.7.2 LOCALIZING TROUBLE TO A UNIT.

Use Table 5-5 to determine which unit in the system is faulty.

5.7.3 PRELIMINARY TROUBLE-SHOOTING.

If the trouble is believed to be in the 1264, use the following procedure (Table 5-6) to locate and rem-

Table 5-6
1264 TROUBLE-SHOOTING

Symptom	Probable Cause	Remedy
1. Pilot lamp extinguished.	Line fuse open. Line fuse blown due to short circuit in power supply or load.	Replace fuse. Check capacitors C201, C202, C203, C204, C205 and replace any defective unit. Check associated oscillator for short circuit.
2. No oscillator output with selector in CW position.	No high voltage applied to oscillator.	Check supply voltage across terminals 15 and 16 of SO101. If voltage is correct, trouble is in oscillator or interconnecting cable. If no supply voltage, check for voltage at cathode of V302. If cathode voltage is present, S401 is probably defective. If voltage is not present, check voltage at plate of V302. If voltage is present, V302 may be defective or there may be a short circuit across C304 or in the associated oscillator. If there is no voltage at the plate of V302, check R201. If open, look for short-circuited capacitor C202 or C203.

Table 5-6 (cont)
1264 TROUBLE-SHOOTING

Symptom	Probable Cause	Remedy
3. Excessive oscillator output, cw or modulated.	Excessive high voltage due to failure of regulator circuits.	Check V301, V302, V303 and V304; replace any defective tubes.
4. Oscillator delivers cw output when selector is set to 1 kHz $\square$ or EXT.	V403 plate current is not cut off due to failure of trigger circuit. Either tube V405 is defective or the 300-volt unregulated supply has failed.	Check V405 and replace if defective. Check supply voltage for V405 across terminals 12 and 14 of modulator board. If low or missing, check C305. Replace if defective. If not, check voltage across terminals 22 and 23 of rectifier board. If no voltage, check C204 and C205 for shorts; check R202 continuity. Replace any defective parts.
5. No square-wave output from oscillator with selector set to 1 kHz $\square$ although output at CW is satisfactory.	Defective tube or defective 300-V unregulated supply.	Check 1 kHz $\square$ output at EXTERNAL INPUT/1 kHz OUTPUT binding posts. If no output, check V404 and replace if defective. Check V403 and replace if defective. If trouble persists, difficulty is probably covered by (4) above.
6. No pulse output with selector set to EXT.	Input pulse too short due to oscillator starting delay. Incorrect drive polarity or amplitude.	Widen input pulse. Check for positive input pulse of 20 V or greater peak amplitude.
7. Square-wave synchronization unsatisfactory with selector set to EXT.	Inadequate input amplitude. Defective tube V405. Defective clamp circuit.	Provide 20-volt peak amplitude square-wave input or 20-V, rms, amplitude sine-wave input. Replace V405. Check CR401 and associated resistors R418, R419, R421, and R420 or R438.
8. Output occurs with no input drive for selector set to EXT.	Defective V405 clamp circuit.	See (7) above.
9. Poor pulse rise time.	Excessive load capacitance. Defective V403. Inadequate grid drive to V403.	Check using standard dummy load (see Figure 5-4). If rise time is satisfactory, trouble is not in modulator. Replace V403. Check cathode voltage on V401A. If incorrect, replace V401. Check R406 and replace if defective.
10. Poor pulse decay time.	Excessive load capacitance. Defective V402. No screen pulse to V402 due to defective clamp tube V401B.	Check using standard dummy load. If decay time is satisfactory, trouble is not in modulator. Replace V402. Replace V401.

edy the most common problems. If further investigation is required, refer to paragraph 5.7.4.

5.7.4 1264 CIRCUIT TESTS.

If the trouble has been localized to the 1264 and the trouble-shooting procedure described in Table 5-6 fails to solve the problem, localize the trouble to

a specific circuit by checking the output voltages and waveforms as listed in Table 5-7.

Other waveforms that are important in the analysis of circuit operation are shown on the schematic diagram, Figure 5-14. The waveforms shown there apply for the 1 kHz $\square$ position of the function switch and provide a check on most aspects of the modulator

Table 5-7
1264 CIRCUIT TESTS

Test Instrument and Range	Connection Points	Function Switch Pos.	Desired Indication	Probable Faulty Circuit			
				Rectifier	Regulator	Modulator	Other
Voltmeter 300 V dc	+ to 15 of SO101 - to 16 of SO101	CW	+300 with CW AMPL fully clock-wise, +200 or less fully ccw	X	X		R402
		STAND BY 1 KHz $\square$, EXT	0				S401
Voltmeter 300 V dc	+ to 1 of SO102 - to 2 of SO102	CW	0				S401
		STAND BY	+240				S401
		1 KHz $\square$, EXT	+260 with MOD AMPL fully cw, +200 or less fully ccw	X	X		R401 R306
Voltmeter 300 V dc	+ to 7 of SO102 - to 2 of SO102	CW	*0 **-40 $\pm$ 10				S401
		1 KHz $\square$	+130 with MOD AMPL fully cw			X	
		STAND BY	*0 **-40 $\pm$ 10				
		EXT	+260 with MOD AMPL fully cw			X	
Voltmeter 12 V dc	13 and 14 of SO101	CW, STAND BY, 1 KHz $\square$, EXT	6.5 V	X	X		T201
Oscilloscope 20 V/cm + 10:1 attenuator, 0.2 ms/s sweep rate, ac coupling	Pin 7 of SO102 ground (pin 3)	1 KHz $\square$	A 230-V pk-pk square wave, 1 ms period with MOD AMPL fully cw, decreasing to 165-Vpk-pk fully ccw	X	X	X	S401
		CW, STAND BY, EXT	0				S401

*Measured with 20,000 Ω /V meter, **Measured with VTVM.

operation. Additional tests and trouble-shooting notes are described in paragraphs 5.7.5 through 5.7.7. Test conditions for the measurements listed in Table 5-7 are:

1. Oscillator disconnected from the 1264.
2. No external drive applied to the EXTERNAL INPUT terminals.
3. Pins 2 and 3 of SO102 connected together and to pin 16 of SO101.
4. Line voltage of 115 V (or 230 V, if so connected) applied.

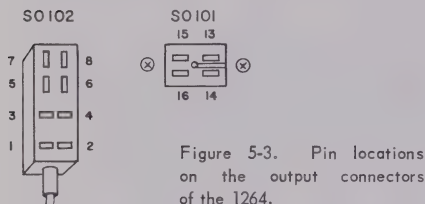


Figure 5-3. Pin locations on the output connectors of the 1264.

Normal variations in the 1264 voltages can result in voltage readings that vary $\pm 10\%$.

5.7.5 CIRCUIT TROUBLE-SHOOTING.

GENERAL.

The following paragraphs describe the procedure for troubleshooting individual circuits in the 1264. Refer also to the voltage and resistance measurements given in paragraph 5.7.6. The equipment required for these tests is listed in Tables 5-1 and 5-8.

Connections Required.

The following connections (see Figure 5-4) should be made between output receptacles and to the dummy load for use as called for in subsequent paragraphs.

1. Pins 2 and 3 of SO102 connected together.
2. Pins 4 and 7 of SO102 connected together and to pin 16 of SO101, and by way of a momentary open switch to one side of a dummy load consisting of a 6-k Ω , 20 W resistor in parallel with a 300-pF, 500-V capacitor.

3. Pin 1 of SO102 to pin 15 of SO101 and to the other side of the dummy load.

These connections will maintain the common power-supply bus at ground (the 1264 instrument case) potential for all positions of the function switch S401.

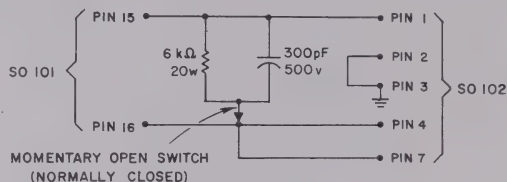


Figure 5-4. Schematic diagram of dummy-load connections.

Modulator

To test for triggering sensitivity and output-pulse characteristics, make connections as described above, set 1264 to EXTERNAL INPUT, and proceed as follows:

- a. Connect the + OUTPUT PULSE terminals of the pulse generator to the EXTERNAL INPUT terminals on the 1264 and to the vertical input terminals on the oscilloscope.
- b. Connect the + SYNC output of the pulse generator to the sync input connector on oscilloscope. Set the oscilloscope for external triggering.
- c. Set the PRF control on the pulse generator to 1 kHz and the PULSE DURATION controls

Table 5-8
EQUIPMENT REQUIRED FOR TROUBLE-SHOOTING
(Also refer to Table 5-1)

Type	Requirements	Model Recommended
Pulse generator	Pulse-repetition rate: 1 kHz Pulse duration: adjustable, 1 μ s to 600 μ s Output voltage: 20 V, pk-pk	GR 1217 Unit Pulse Generator (with GR 1201 Power Supply)
Sine-wave generator	Frequency range: 20 to 60 kHz Output voltage: 15 V into input impedance of 10 k Ω or less	GR 1310 Oscillator
Ohmmeter	Range: 1 Ω to 1 M Ω Accuracy: $\pm 10\%$	GR 1806 Electronic Voltmeter

to 600 μ s. Set the AMPLITUDE control for 20 volts, as measured on the oscilloscope. Mark this 20-volt level on the AMPLITUDE control and then disconnect the + OUTPUT PULSE of the pulse generator from the oscilloscope.

- d. Connect the vertical input of the oscilloscope, using the 10:1 attenuator probe, to observe the modulator output pulse. The oscilloscope ground should be connected to pin 3 of SO102 (1264 case), and the probe input terminal to pin 7 of SO102. Set the oscilloscope for ac coupling and 1264 function switch to EXTERNAL INPUT.
- e. Vary the output-pulse duration of the pulse generator from 600 μ s to 1 μ s, and observe the modulator output pulse on the oscilloscope for the following:
 1. Stable waveform, indicating proper operation of the Schmitt trigger in the 1264.
 2. With MODULATED AMPLITUDE control fully clockwise, the output pulse amplitude should be at least 210 volts peak.
 3. Overshoot less than 5%.
 4. Rise and decay times less than 1.5 μ s as measured between the 10 and 90% points.
 5. Minimum pulse width, with a 1- μ s pulse-generator input, must be 1.5 μ s or less, as measured between the 50% points.
- f. Disconnect the pulse generator from the oscilloscope and from the 1264. Connect the output of the sine-wave generator to the EXTERNAL INPUT of the 1264. Monitor the output of the sine-wave generator with the voltmeter and monitor the output of the 1264 with the oscilloscope.
- g. Set the sine-wave generator for a 20-volt, rms, sine-wave output and check the oscilloscope display for a stable waveform on input frequencies from 20 Hz to 50 kHz.

Assuming that the supply voltages as determined in paragraph 5.7.4 are correct, absence of an output pulse or poor triggering may be due to one of the following:

1. Signal to EXTERNAL INPUT less than 20 volts, rms, for sine-wave input, or less than 20 volts, peak pulse, or pulse input negative instead of positive, or less than 1 μ s in duration.
2. V401, V402, V403, V405, or CR401 faulty.
3. Negative 300-V unregulated supply faulty.

If the triggering is reliable but the output pulse shape is poor or of inadequate amplitude, V401, V402, or V403 is probably defective. V401 and V402 affect the pulse decay characteristics, while V403 controls the rise and amplitude characteristics. Poor rise and decay times may also be caused by excessive capacitance in the dummy load.

Waveforms at various significant points in the circuit are shown on the schematic diagram, Figure 5-14.

Multivibrator.

To check the frequency range and duty ratio of the internal 1-kHz modulation, make the connections described under Connections Required, and proceed as follows:

- a. Connect the vertical input of the oscilloscope, using the 10:1 attenuator probe, to observe the modulator output pulse. The oscilloscope ground should be connected to pin 3 of SO102 (1264 case), and the probe input terminal to pin 7 of SO102.
- b. Set the oscilloscope for an internally triggered display with a sweep rate of 100 μ s/cm. Set the oscilloscope for ac coupling and 1264 function switch to 1 kHz $\square$.
- c. Set the 1 kHz Δ FREQ and 1 kHz DUTY RATIO controls of the 1264 to produce a total duration of 1 ms for one complete cycle, with each half cycle being 500 μ s. The pointers on the knobs should be approximately in the 12 o'clock position.

NOTE

The dual control feature (refer to paragraph 4.5) of the 1 kHz Δ FREQ control can cause an apparent ambiguity of knob position as great as $\pm 40^\circ$.

- d. Check the range of the 1 kHz Δ FREQ control by observing the period as the control setting is varied. With the control fully counterclockwise, the period should be at least 1.2 ms, corresponding to a frequency slightly below 850 Hz, and with the control fully clockwise, the period should be less than 0.85 ms, corresponding to a frequency slightly above 1150 Hz. At a 1-ms period setting, the total range of the vernier adjustment should be approximately 7 μ s, barely discernible on the 1-ms sweep.
- e. Check the range of the 1 kHz DUTY RATIO control with the 1 kHz Δ FREQ control set at the dot. The period of a half cycle should be adjustable over a range of at least $\pm 25 \mu$ s.

The 1-kHz multivibrator circuit consists of V404 and associated components, the positive supply, and the Y heater bus. The 1-kHz multivibrator circuit is unaffected by the negative supply. The typical output waveform is shown on the schematic diagram, Figure 5-14. If there is no output from the multivibrator, V404 is probably faulty.

If the 1 kHz Δ FREQ control range is insufficient, or the 1 kHz DUTY RATIO control range is insufficient, or the duty ratio improper, V404, R413, R414, R415, C403, or C404 is probably defective.

Rectifier Circuit.

Most troubles in this section of the instrument will either cause the line fuses to blow or will cause excessive power to be drawn from the power line. Check the input power as follows:

- Set the autotransformer to zero volts and connect the 1264 to it. Set the 1264 function switch to CW.
- Slowly increase the line voltage to 115 volts and compare the input power with the values listed in Table 5-9.

Table 5-9
1264 INPUT POWER

Line Voltage	Function-Switch Setting	Input Power	
		No-load	Full-load
115	CW	50 watts	70 watts
115	1 kHz □		65 watts

NOTE

For full load, connect 6-k Ω plate load and 6.5- Ω heater load simultaneously; refer to paragraph 5.6.2.

With the input voltage set to 115 volts, output voltages from the rectifier filter circuits should be as listed in Table 5-10. All terminals listed are located

on the vertical circuit board supported by the power transformer, and are observed with the dummy load connected, the function switch set to 1 kHz □, and the MODULATED AMPLITUDE control fully clockwise. Measurements may be made with the GR 1806 Electronic Voltmeter.

If there is no output voltage between terminals 21 and 23, and R201 is open, check to be sure that C202 and C203 are not short-circuited, and also that RX202 and RX203 have not been damaged. If there is no output voltage between terminals 23 and 22, and R202 is open, check to be sure that C204 and C205 are not short-circuited, and also that RX204 and RX205 have not been damaged.

If the output voltage from one of the dc supplies is low, it is probable that excessive loading is being applied by the modulator circuits or the external load. If the output voltage is high, a tube in the modulator or regulator circuits is probably defective.

Regulated Power Supply.

Make connections as described under Connections Required. Connect the 1264 power cord to the output of the autotransformer. Use the differential voltmeter to perform the following checks and adjustments of dc voltage (Table 5-11), and the sensitive voltmeter to check ripple (refer to table 5-1). The ground or common terminals of the voltmeters should be connected to terminal 3 of SO102 (1264 case), and the high input terminal of the voltmeters to terminal 1 of SO102.

Table 5-10
RECTIFIER-CIRCUIT VOLTAGES

Voltmeter Scale	+ Terminal No.	- Terminal No.	Normal Voltage	Possible Cause of Trouble
1500 dc	21	23	425	R201, RX202, RX203, C202, C203
150 dc	20	19	100	RX201, C201
1500 dc	23	22	300	R202, RX204, RX205, C204, C205
15 dc	502	501	10	* RX101, RX102, RX103, RX104, C101
15 ac	15	16	9.4	T201
15 ac	11	12	6.3	T201
15 ac	7	8	6.1	T201
15 ac	13	14	6.1	T201

Table 5-11
REGULATOR-CIRCUIT TESTS

Purpose of Test	1264 Control Settings			Line Voltage Setting	DC Voltage	Ripple Voltage
	Function	MOD AMP	CW AMP			
Adjustment of maximum output voltage	CW	--	CW	115	Adjust R323 for 300 V	---
CW AMP control range	CW	--	CCW	115	< 200 V	---
MOD AMP control range	EXT	CW	--	115	250 to 260 V	---
MOD AMP control range	EXT	CCW	--	115	< 200 V	---
Line voltage regulation and ripple at low line	CW	--	CW	115	300.0 Change	---
				103	< ± 0.5 V	< 1 mV
Load regulation at low line	CW	--	CW	103	Change < ± 0.25 V upon removing load	
Line voltage regulation at high line	CW	--	Set for 200.0 V output	115	200.0 Change	
				128	< ± 0.5 V	
Load regulation and ripple at high line	CW	--	Set for 200.0 V output	128	Change < ± 0.25 V upon removing load	< 1 mV

The regulator circuit consists of V301 and V304 and associated components. It is not associated in any way with the negative supply, but requires adequate output from the main positive supply and also from the lossier-tube screen supply. Tests of these supplies are described above under the heading Rectifier Circuit. If these voltages are adequate, a defective tube V301 or V304 is probably responsible for inadequate regulation against line or load changes, as well as for excessive ripple.

Apparent excessive ripple may also be caused by hum pickup on unshielded leads between the sensitive voltmeter and the power supply. If the ripple level appears to change with orientation of the sensitive voltmeter leads, they are probably inadequately shielded. Another cause of apparently excessive ripple is a ground loop existing through the ground lead of voltmeter and power supply three-wire power cords. In this case, substitute a two-wire power cord on either the voltmeter or the 1264 to open up the unwanted loop.

Regulated Heater Supply.

If the output voltage is regulated and within ± 0.3 V of 6.5, reset R507. If this adjustment drifts, check R506, R508, CR503, and Q505.

If the output voltage is unregulated, measure voltages at key points, comparing them with those given in Figure 5-14 and Table 5-13.

Measure the output ripple (120 cycle) at full load. If the ripple is excessive at full load, but drops sharply as the load is reduced, the current limiter may be at fault. Check R501, and CR501. An increased voltage drop across R501 will cause this difficulty.

If the output ripple is excessive only at low line voltages, check R101, R102, R103, R104, and C101.

If the 60-cycle ripple is excessive at full load, one of the four rectifiers is probably faulty.

5.7.6 VOLTAGE AND RESISTANCE MEASUREMENTS.

Most circuit difficulties in the 1264 Modulating Power Supply will be indicated by incorrect voltages at various tube terminals or by improper values of circuit resistance. Normal values are listed in Table 5-12. They were measured with a GR 1806 Electronic Voltmeter under the following test conditions:

1. All voltage measurements are made with 115-V line voltage. The function switch is set to 1 kHz and the MODULATED AMPLITUDE control set to produce a B+ voltage of 250 volts (pin 1 of SO102 is B+, pin 2 of SO102 is B-).

2. For resistance measurements, set all panel controls fully counterclockwise and ground terminals 19 through 23 of the rectifier circuit board and terminal 6 of the modulator circuit board (see Figure 5-6).

CAUTION

Do not apply power to the 1264 with these grounds in place.

Table 5-12
VOLTAGE AND RESISTANCE MEASUREMENTS

TUBE (TYPE)	PIN	DC VOLTS TO COMMON	OHMS TO GND	TUBE (TYPE)	PIN	DC VOLTS TO COMMON	OHMS TO GND
V301 (6AN8)	1	425	0	V402 (5763)	1	250	300k
	2	235	2.1 M		3	130	∞
	3	240	430k		4	150	180k
	4	100	900k		5	150	180k
	5	100	900k		6	250	∞
	6	235	2.1 M		7	130	∞
	7	250	0		8	120	∞
	8	150	72k		9	120	∞
	9	155	33k				
V302 (6AV5GA)	1	240	430k	V403 (5763)	1	120	∞
	2	100	900k		3	0	0
	3	250	0		4	-60	110k
	5	425	0		5	-60	110k
	7	100	900k		6	160	310k
	8	350	1k		7	0	0
V303 (5651)	1	85	40k		8	-20	∞
	4	0	0		9	-20	∞
	5	85	40k				
V304 (5965)	1	155	33k	V404 (5963)	1	75	280k
	2	37	500k		2	-20	1.1M
	3	39	6.8k		3	11	18k
	4	100	900k		4	-60	110k
	5	100	900k		5	-60	110k
	6	155	33k		6	65	280k
	7	37	51k		7	-30	1M
	8	39	6.8k		8	0	0
	9	100	900k		9	-60	110k
V401 (5965)	1	250	300k	V405 (5963)	1	-50	6.8k
	2	85	510k		2	-190	See Note
	3	88	∞		3	-190	8k
	4	150	180k		4	-60	110k
	5	150	180k		5	-60	110k
	6	250	300k		6	-20	∞
	7	250	300k		7	-200	95k
	8	250	∞		8	-190	8k
	9	150	180k		9	-60	110k

NOTE

Departures of up to 20% from the tabulated values should not be considered abnormal. Resistance at pin 2 of V405 may be 850 kΩ or 25 kΩ, depending on ohmmeter polarity.

Table 5-13
VOLTAGE MEASUREMENTS FOR HEATER SUPPLY (UNLOADED)

Transistor	Test* Point	Voltage (dc)	Transistor	Test* Point	Voltage (dc)
Q501	Emitter	-12 V	Q504	Emitter	-6.5 V
	Base	-11.4 V		Base	-7.2 V
	Collector	-6.6 V		Collector	-10.7 V
Q502	Emitter	-11.4 V	Q505	Emitter	-4.7 V
	Base	-10.7 V		Base	-5.4 V
	Collector	-6.6 V		Collector	-11.2 V
Q503	Emitter	-11.8 V			
	Base	-11.2 V			
	Collector	-10.7 V			

*Use AT502 as a reference point for all measurements.

Voltage measurements for transistors in the regulated heater supply are listed in Table 5-13.

5.7.7 FUNCTION SWITCH OPERATION.

If the sequence of voltages as a function of switch position is not as described in Table 5-7, operation of the function switch should be checked.

Disconnect the 1264 from the line voltage and from any auxiliary equipment. Check the operation of the function switch by performing the following resistance checks. The common bus is available at terminal 13 on the modulator etched-circuit board, and the positive bus at terminal 4 on the regulator circuit board.

Table 5-14
FUNCTION SWITCH MEASUREMENTS

Ohmmeter Connections	CW	Function Switch Setting		
		STAND BY	1 kHz □	EXTERNAL
SO102 pin				
3 to ground	short	short	short	short
3 to 4	short	open	open	open
5 to 6	short	short	open	open
7 to 8	short	short	open	open
1 to positive	open	short	short	short
1 to common	open	80-100 kΩ	60-80 kΩ	60-80 kΩ
2 to common	open	short	short	short
3 to common	open	open	open	open
4 to common	open	open	open	open
5 to common	open	open	open	open
6 to common	open	open	open	open
7 to common	open	open	open	open
8 to common	open	open	180 kΩ	180 kΩ
SO101 pin				
13 to common	open	open	open	open
14 to common	open	open	open	open
15 to common	80-100 kΩ	open	open	open
15 to positive	short	open	open	open
16 to common	short	open	open	open

5.8 KNOB REMOVAL.

If it should be necessary to remove the knob on a front-panel control, either to replace one that has been damaged or to replace the associated control, proceed as follows:

- Grasp the knob firmly with the fingers and pull the knob straight away from the panel.
- Observe the position of the set screw in the bushing, with respect to any panel marking (or at the full ccw position of a continuous control).
- Release the set screw and pull the bushing off the shaft.

NOTE

To separate the bushing from the knob, if for any reason they should be combined off the instrument, drive a machine tap a turn or two into the bushing for a sufficient grip for easy separation.

5.9 KNOB INSTALLATION.

To install a knob assembly on the control shaft:

- Mount the bushing on the shaft, using a small slotted piece of wrapping paper as a shim for adequate panel clearance.
- Orient the set screw on the bushing with respect to the panel-marking index and lock the set screw.

NOTE

Make sure that the end of the shaft does not protrude through the bushing or the knob won't set properly.

- c. Place the knob on the bushing with the retention spring opposite the set screw.
- d. Push the knob in until it bottoms and pull it slightly to check that the retention spring is seated in the groove in the bushing.

NOTE

If the retention spring in the knob comes loose, reinstall it in the interior notch with the small slit in the outer wall.

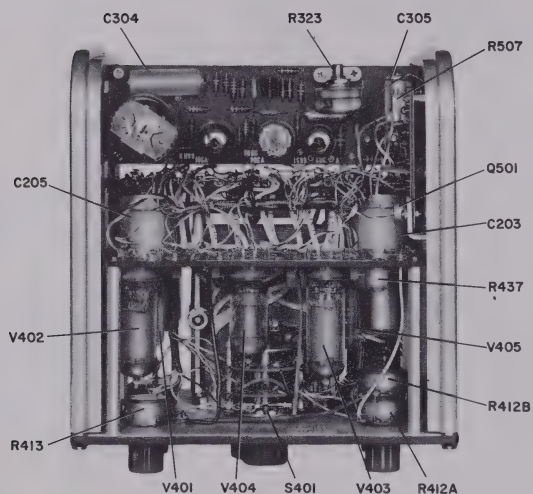


Figure 5-5. Top interior view of the 1264.

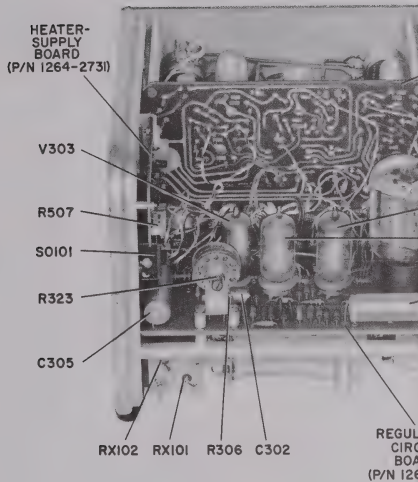


Figure 5-6. Rear interior view of the 1264-P1

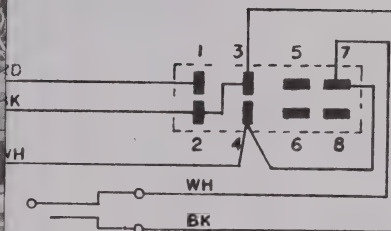


Figure 5-8. Schematic diagram of the 1264-P1 Adaptor Cable.

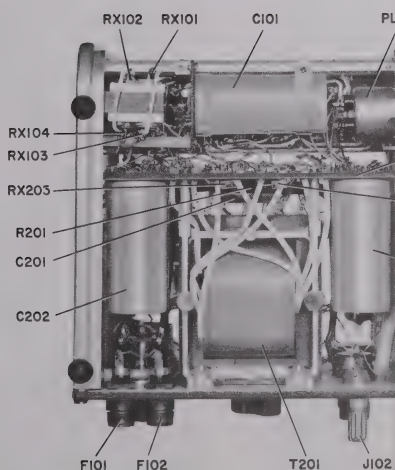


Figure 5-7. Bottom interior view of the 1264-P1

- c. Place the knob on the bushing with the retention spring opposite the set screw.
- d. Push the knob in until it bottoms and pull it slightly to check that the retention spring is seated in the groove in the bushing.

NOTE

If the retention spring in the knob comes loose, reinstall it in the interior notch with the small slit in the outer wall.

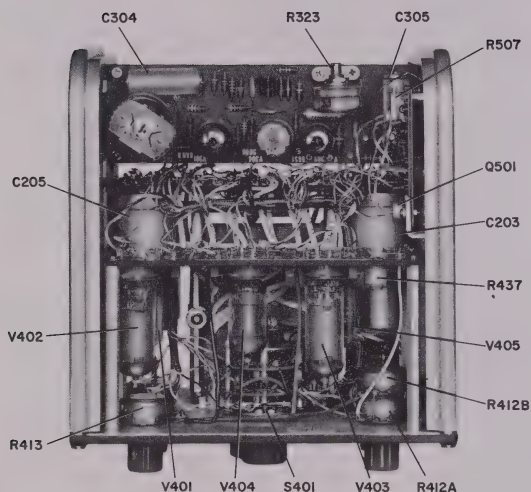


Figure 5-5. Top interior view of the 1264.

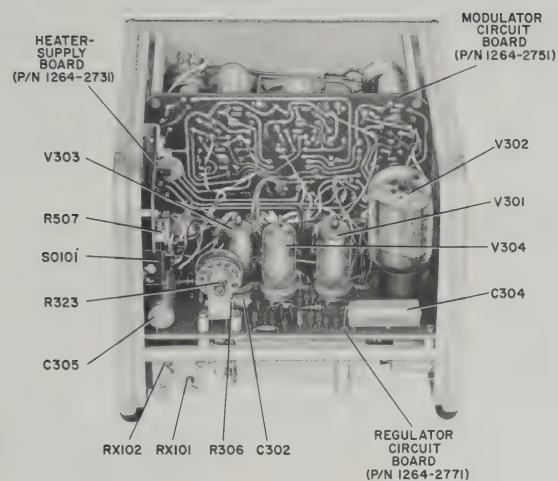


Figure 5-6. Rear interior view of the 1264.

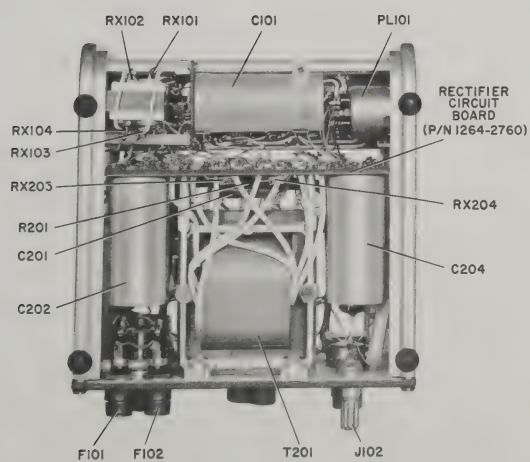


Figure 5-7. Bottom interior view of the 1264.

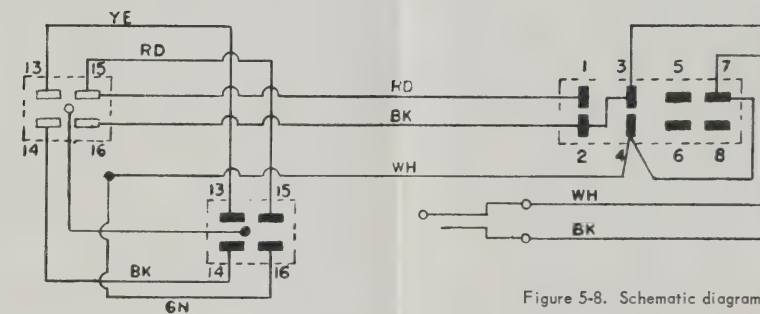
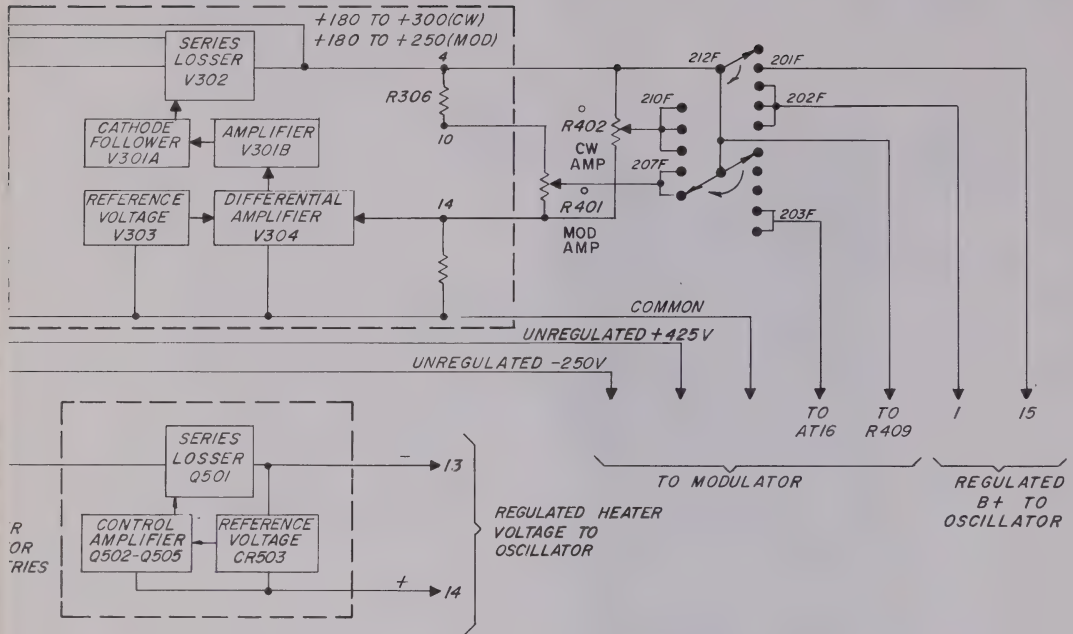


Figure 5-8. Schematic diagram of the 1264-P1 Adaptor Cable.

SYMBOL SERIES 300
REGULATOR CIRCUIT



SYMBOL SERIES 400

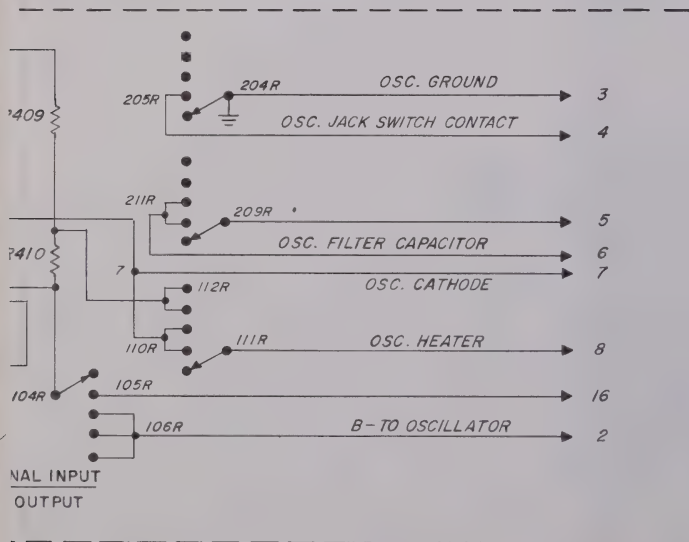
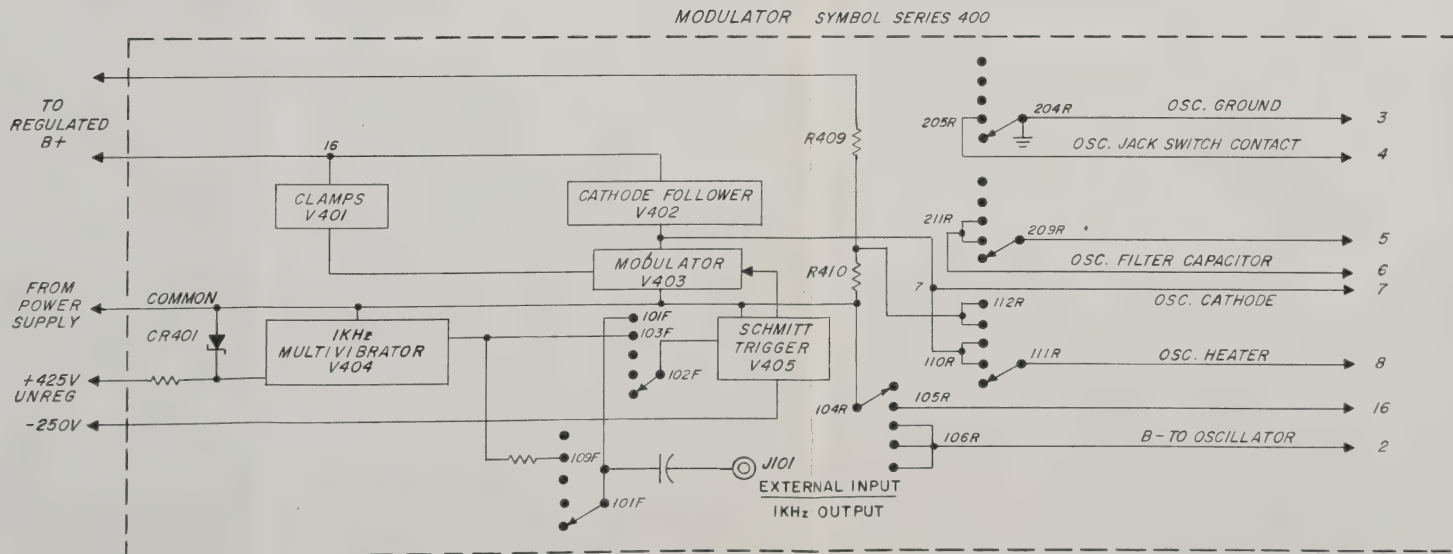
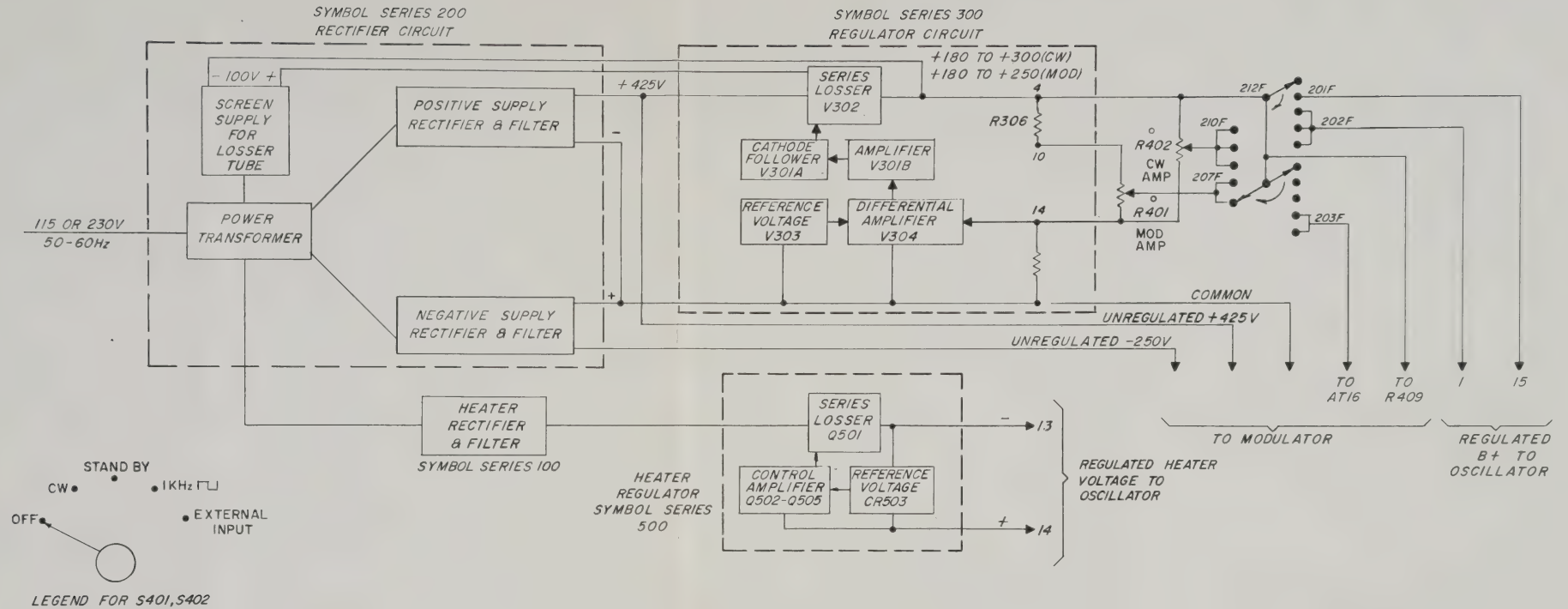


Figure 5-9. Block diagram for the 1264-B Modulating Power Supply.

ELECTRICAL PARTS LIST

Ref. No.	Description	GR	Fed.		Fed. Stock No.
		Part No.	Mfg. Code	Mfg. Part No.	
CAPACITORS					
C101A	1500 μ F				
C101B	Electrolytic, 750 μ F +100-10% 25 V	4450-0700	90201	203828510C10X2	5910-976-9415
C101C	750 μ F				
C102	Plastic, 0.15 μ F $\pm$ 10% 600 V	4860-9400	84411	663F, .15 μ F 10%	5910-079-1703
C201	Electrolytic, 16 μ F +100-10% 150 V	4450-0200	00656	PRS-EP150	5910-829-3313
C202A	90 μ F				
C202B	Electrolytic, 30 μ F +100-10% 300 V	4450-3400	37942	104111G156	5910-918-9253
C202C	30 μ F				
C203A	90 μ F				
C203B	Electrolytic, 30 μ F +100-10% 300 V	4450-3400	37942	104111G156	5910-918-9253
C203C	30 μ F				
C204A	90 μ F				
C204B	Electrolytic, 30 μ F +100-10% 300 V	4450-3400	37942	104111G156	5910-918-9253
C204C	30 μ F				
C205A	90 μ F				
C205B	Electrolytic, 30 μ F +100-10% 300 V	4450-3400	37942	104111G156	5910-918-9253
C205C	30 μ F				
C301	Ceramic, .01 μ F +80-20% 500 V	4406-3109	72982	811000X5U103X	5910-977-7579
C302	Wax, .047 μ F $\pm$ 10% 400 V	5020-1000	80183	78P4734953	5910-857-7244
C303	Ceramic, .01 μ F +80-20% 500 V	4406-3109	72982	811.000X5U103X	5910-977-7579
C304	Electrolytic, 4 μ F +100-10% 475 V	4450-2000	80183	D32845	5910-893-0879
C305	Electrolytic, 4 μ F +100-10% 475 V	4450-2000	80183	D32845	5910-893-0879
C401	Mica, 180 pF $\pm$ 10% 500 V	4700-0500	14655	22AST15	
C402	Mica, .001 μ F $\pm$ 10% 300 V	4700-0200	14655	22AST15	
C403	Mica, .001 μ F $\pm$ 1% 300 V	4710-0100	14655	22A, .001 μ F 1%	5910-068-0840
C404	Mica, .001 μ F $\pm$ 1% 300 V	4710-0100	14655	22A, .001 μ F 1%	5910-068-0840
C405	Ceramic, .0047 μ F $\pm$ 10% 500 V	4407-2478	72982	811, 000X5U103X	5910-977-7579
C406	Ceramic, 10 pF $\pm$ 10% 500 V	4400-2999	72982	315 NPO, 10 pF	
C407	Plastic, 3.3 μ F $\pm$ 10% 100 V	4860-8400	84411	663UW, 3.3 μ F $\pm$ 10%	5910-799-9278
C501	Ceramic, 0.1 μ F +80-20% 50 V	4403-4100	80131	CC63, .1 μ F +80-20%	5910-974-5699
C502	Electrolytic, 15 μ F $\pm$ 20% 20 V	4450-5200	56289	150 D156X002002	5910-855-6335
RESISTORS					
R101	Wire wound, 6.8 Ω $\pm$ 10% 1/2 W	6760-9689 (Part of P101)	75042	BWH, 6.8 Ω $\pm$ 10% 1/2 W	
R102	Composition, 1 M Ω $\pm$ 5% 1/2 W	6100-5105	01121	RC20GF105J	5905-192-0390
R201	Power, 82 Ω $\pm$ 5% 10 W	6670-0825	80183	247E, 82 Ω $\pm$ 5%	5905-448-5692
R202	Wire wound, 47 Ω $\pm$ 10% 2 W	6760-0479	75042	BWH 47 Ω $\pm$ 10%	
R301	Composition, 10 M Ω $\pm$ 5% 1/2 W	6100-6105	01121	RC20GF106J	5905-279-1865
R302	Composition, 1 k Ω $\pm$ 5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R303	Composition, 1 k Ω $\pm$ 5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R304	Composition, 2.7 M Ω $\pm$ 5% 1/2 W	6100-5275	01121	RC20GF275J	5905-279-1881
R305	Composition, 120 k Ω $\pm$ 5% 1/2 W	6100-4125	01121	RC20GF124J	5905-192-3981
R306	Composition, 100 k Ω $\pm$ 5% 1/2 W	6100-4105	01121	RC20GF104J	5905-195-6761
R307	Composition, 390 k Ω $\pm$ 5% 1/2 W	6100-4395	01121	RC20GF394J	5905-279-2517
R308	Composition, 4.3 M Ω $\pm$ 5% 1/2 W	6100-5435	01121	RC20GF435J	5905-279-2511
R309	Composition, 100 k Ω $\pm$ 5% 1/2 W	6100-4105	01121	RC20GF104J	5905-195-6761
R310	Composition, 56 k Ω $\pm$ 5% 1 W	6110-3565	01121	RC20GF563J	5905-171-1986
R311	Film, 100 k Ω $\pm$ 1% 1/4 W	6350-3100	75042	CEB, 100 k Ω $\pm$ 1%, 1/4 W	5905-539-3982
R312	Film, 75 k Ω $\pm$ 1% 1/4 W	6350-2750	75042	CEB, 75 k Ω $\pm$ 1%, 1/4 W	5905-556-3058
R313	Composition, 1 k Ω $\pm$ 5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R314	Composition, 33 k Ω $\pm$ 5% 1/2 W	6100-3335	01121	RC20GF333J	5905-171-1998
R315	Composition, 33 k Ω $\pm$ 5% 1/2 W	6100-3335	01121	RC20GF333J	5905-171-1998
R316	Composition, 6.8 k Ω $\pm$ 5% 1/2 W	6100-2685	01121	RC20GF682J	5905-279-3503
R317	Composition, 180 k Ω $\pm$ 5% 1/2 W	6100-4185	01121	RC20GF184J	5905-192-0660
R318	Composition, 2.2 M Ω $\pm$ 5% 1/2 W	6100-5225	01121	RC20GF225J	5905-190-8885
R319	Composition, 1 k Ω $\pm$ 5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R320	Composition, 1.5 M Ω $\pm$ 5% 1/2 W	6100-5155	01121	RC20GF155J	5905-279-1754
R321	Composition, 270 k Ω $\pm$ 5% 1/2 W	6100-4475	01121	RC20GF474J	5905-279-2515
R322	Film, 164 k Ω $\pm$ 1% 1/4 W	6350-3164	75042	CEB, 164 k Ω $\pm$ 1% 1/4 W	
R323	Potentiometer, 10 k Ω $\pm$ 10%	6010-0900	01121	JU, 10 k Ω $\pm$ 10%	
R324	Composition, 36 k Ω $\pm$ 5% 1/2 W	6100-3365	01121	RC20GF363J	5905-249-4256
R325	Composition, 3.3 k Ω $\pm$ 10% 1 W	6110-2339	01121	RC32GF332J	
R401	Potentiometer, 100 k Ω $\pm$ 10%	6000-0900	01121	JU, 100 k Ω $\pm$ 10%	
R402	Potentiometer, 250 k Ω $\pm$ 10%	6000-1100	01121	JU, 250 k Ω $\pm$ 10%	

POWER SUPPLIES



ELECTRICAL PARTS LIST

Ref. No.	Description	GR Part No.	Fed. Mfg. Code	Mfg. Part No.	Fed. Stock No.
CAPACITORS					
C101A	1500 μ F				
C101B	Electrolytic, 750 μ F +100-10% 25 V	4450-0700	90201	203828510C10X2	5910-976-9415
C101C	750 μ F				
C102	Plastic, 0.15 μ F $\pm$ 10% 600 V	4860-9400	84411	663F, .15 μ F 10%	5910-079-1703
C201	Electrolytic, 16 μ F +100-10% 150 V	4450-0200	00656	PRS-EP150	5910-829-3313
C202A	90 μ F				
C202B	Electrolytic, 30 μ F +100-10% 300 V	4450-3400	37942	104111G156	5910-918-9253
C202C	30 μ F				
C203A	90 μ F				
C203B	Electrolytic, 30 μ F +100-10% 300 V	4450-3400	37942	104111G156	5910-918-9253
C203C	30 μ F				
C204A	90 μ F				
C204B	Electrolytic, 30 μ F +100-10% 300 V	4450-3400	37942	104111G156	5910-918-9253
C204C	30 μ F				
C205A	90 μ F				
C205B	Electrolytic, 30 μ F +100-10% 300 V	4450-3400	37942	104111G156	5910-918-9253
C205C	30 μ F				
C301	Ceramic, .01 μ F +80-20% 500 V	4406-3109	72982	811000X5U103X	5910-977-7579
C302	Wax, .047 μ F $\pm$ 10% 400 V	5020-1000	80183	78P4734953	5910-857-7244
C303	Ceramic, .01 μ F +80-20% 500 V	4406-3109	72982	811.000X5U103X	5910-977-7579
C304	Electrolytic, 4 μ F +100-10% 475 V	4450-2000	80183	D32845	5910-893-0879
C305	Electrolytic, 4 μ F +100-10% 475 V	4450-2000	80183	D32845	5910-893-0879
C401	Mica, 180 pF $\pm$ 10% 500 V	4700-0500	14655	22A5T15	
C402	Mica, .001 μ F $\pm$ 10% 300 V	4700-0200	14655	22A5T15	
C403	Mica, .001 μ F $\pm$ 1% 300 V	4710-0100	14655	22A, .001 μ F 1%	5910-068-0840
C404	Mica, .001 μ F $\pm$ 1% 300 V	4710-0100	14655	22A, .001 μ F 1%	5910-068-0840
C405	Ceramic, .0047 μ F $\pm$ 10% 500 V	4407-2478	72982	811, 000X5U103X	5910-977-7579
C406	Ceramic, 10 pF $\pm$ 10% 500 V	4400-2999	72982	315 NPO, 10 pF	
C407	Plastic, 3.3 μ F $\pm$ 10% 100 V	4860-8400	84411	663UW, 3.3 μ F $\pm$ 10%	5910-799-9278
C501	Ceramic, 0.1 μ F +80-20% 50 V	4403-4100	80131	CC63, .1 μ F +80-20%	5910-974-5699
C502	Electrolytic, 15 μ F $\pm$ 20% 20 V	4450-5200	56289	150 D156X002002	5910-855-6335
RESISTORS					
R101	Wire wound, 6.8 Ω $\pm$ 10% 1/2 W	6760-9689 (Part of P101)	75042	BWH, 6.8 Ω $\pm$ 10% 1/2 W	
R102	Composition, 1 M Ω $\pm$ 5% 1/2 W	6100-5105	01121	RC20GF105J	5905-192-0390
R201	Power, 82 Ω $\pm$ 5% 10 W	6670-0825	80183	247E, 82 Ω $\pm$ 5%	5905-448-5692
R202	Wire wound, 47 Ω $\pm$ 10% 2 W	6760-0479	75042	BWH 47 Ω $\pm$ 10%	
R301	Composition, 10 M Ω $\pm$ 5% 1/2 W	6100-6105	01121	RC20GF106J	5905-279-1865
R302	Composition, 1 k Ω $\pm$ 5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R303	Composition, 1 k Ω $\pm$ 5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R304	Composition, 2.7 M Ω $\pm$ 5% 1/2 W	6100-5275	01121	RC20GF275J	5905-279-1881
R305	Composition, 120 k Ω $\pm$ 5% 1/2 W	6100-4125	01121	RC20GF124J	5905-192-3981
R306	Composition, 100 k Ω $\pm$ 5% 1/2 W	6100-4105	01121	RC20GF104J	5905-195-6761
R307	Composition, 390 k Ω $\pm$ 5% 1/2 W	6100-4395	01121	RC20GF394J	5905-279-2517
R308	Composition, 4.3 M Ω $\pm$ 5% 1/2 W	6100-5435	01121	RC20GF435J	5905-279-2511
R309	Composition, 100 k Ω $\pm$ 5% 1/2 W	6100-4105	01121	RC20GF104J	5905-195-6761
R310	Composition, 56 k Ω $\pm$ 5% 1 W	6110-3565	01121	RC20GF563J	5905-171-1986
R311	Film, 100 k Ω $\pm$ 1% 1/4 W	6350-3100	75042	CEB, 100 k Ω $\pm$ 1%, 1/4 W	5905-539-3982
R312	Film, 75 k Ω $\pm$ 1% 1/4 W	6350-2750	75042	CEB, 75 k Ω $\pm$ 1%, 1/4 W	5905-556-3058
R313	Composition, 1 k Ω $\pm$ 5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R314	Composition, 33 k Ω $\pm$ 5% 1/2 W	6100-3335	01121	RC20GF333J	5905-171-1998
R315	Composition, 33 k Ω $\pm$ 5% 1/2 W	6100-3335	01121	RC20GF333J	5905-171-1998
R316	Composition, 6.8 k Ω $\pm$ 5% 1/2 W	6100-2685	01121	RC20GF682J	5905-279-3503
R317	Composition, 180 k Ω $\pm$ 5% 1/2 W	6100-4185	01121	RC20GF184J	5905-192-0660
R318	Composition, 2.2 M Ω $\pm$ 5% 1/2 W	6100-5225	01121	RC20GF225J	5905-190-8885
R319	Composition, 1 k Ω $\pm$ 5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R320	Composition, 1.5 M Ω $\pm$ 5% 1/2 W	6100-5155	01121	RC20GF155J	5905-279-1754
R321	Composition, 270 k Ω $\pm$ 5% 1/2 W	6100-4475	01121	RC20GF474J	5905-279-2515
R322	Film, 164 k Ω $\pm$ 1% 1/4 W	6350-3164	75042	CEB, 164 k Ω $\pm$ 1% 1/4 W	
R323	Potentiometer, 10 k Ω $\pm$ 10%	6010-0900	01121	JU, 10 k Ω $\pm$ 10%	
R324	Composition, 36 k Ω $\pm$ 5% 1/2 W	6100-3365	01121	RC20GF363J	5905-249-4256
R325	Composition, 3.3 k Ω $\pm$ 10% 1 W	6110-2339	01121	RC32GF332J	
R401	Potentiometer, 100 k Ω $\pm$ 10%	6000-0900	01121	JU, 100 k Ω $\pm$ 10%	
R402	Potentiometer, 250 k Ω $\pm$ 10%	6000-1100	01121	JU, 250 k Ω $\pm$ 10%	

ELECTRICAL PARTS LIST (cont)

Ref. No.	Description	GR	Fed.	Mfg. Part No.	Fed. Stock No.
		Part No.	Mfg. Code		
R403	Composition, 120 k Ω $\pm$ 5% 1/2 W	6100-4125	01121	RC20GF124J	5905-192-3981
R404	Composition, 180 k Ω $\pm$ 5% 1/2 W	6100-4185	01121	RC20GF184J	5905-192-0660
R405	Composition, 470 k Ω $\pm$ 5% 1/2 W	6100-4475	01121	RC20GF474J	5905-279-2515
R406	Composition, 12 k Ω $\pm$ 5% 2 W	6120-3125	01121	RC42GF123J	5905-249-4210
R407	Composition, 10 k Ω $\pm$ 5% 2 W	6120-3105	01121	RC42GF103J	5905-185-8516
R408	Composition, 330 Ω $\pm$ 5% 1/2 W	6100-1335	01121	RC20GF331J	5905-192-3971
R409	Composition, 240 k Ω $\pm$ 5% 1/2 W	6100-4245	01121	RC20GF244J	5905-279-2521
R410	Composition, 360 k Ω $\pm$ 5% 1/2 W	6100-4365	01121	RC20GF364J	5905-279-2520
R411	Composition, 180 k Ω $\pm$ 5% 1/2 W	6100-4185	01121	RC20GF184J	5905-192-0660
R412A	Potentiometer, 25 k Ω $\pm$ 10%	6045-2030	01121	JT, 25 k Ω $\pm$ 10%	
R412B	250 k Ω $\pm$ 10%				
R413	Potentiometer, 100 k Ω $\pm$ 10%	6000-0900	01121	JU, 100 k Ω $\pm$ 10%	
R414	Film, 604 k Ω $\pm$ 1% 1/2 W	6450-3604	75042	CEC, 604 k Ω $\pm$ 1%	
R415	Film, 787 k Ω $\pm$ 1% 1 W	6450-3604	75042	CEC, 604 k Ω $\pm$ 1%	
R416	Composition, 180 k Ω $\pm$ 5% 1/2 W	6100-4185	01121	RC20GF184J	5905-192-0660
R417	Composition, 15 k Ω $\pm$ 5% 1/2 W	6100-3155	01121	RC20GF153J	5905-279-2616
R418	Composition, 150 k Ω $\pm$ 5% 1/2 W	6100-4155	01121	RC20GF154J	5905-279-2522
R419	Composition, 27 k Ω $\pm$ 5% 1/2 W	6100-3275	01121	RC20GF273J	5905-279-3499
R420	Composition, 5.6 M Ω $\pm$ 5% 1/2 W	6100-5565	01121	RC20GF565J	5905-279-3838
R421	Composition, 1 M Ω $\pm$ 5% 1/2 W	6100-5105	01121	RC20GF105J	5905-192-0390
R422	Composition, 100 Ω $\pm$ 5% 1/2 W	6100-1105	01121	RC20GF101J	5905-190-8889
R423	Composition, 150 k Ω $\pm$ 5% 1/2 W	6100-4155	01121	RC20GF154J	5905-279-2522
R424	Composition, 470 k Ω $\pm$ 5% 1/2 W	6100-4475	01121	RC20GF474J	5905-279-2515
R425	Composition, 6.8 k Ω $\pm$ 5% 2 W	6120-2685	01121	RC20GF682J	5905-279-3503
R426	Composition, 4.3 k Ω $\pm$ 5% 2 W	6120-2435	01121	RC42GF432J	
R427	Composition, 470 k Ω $\pm$ 5% 1/2 W	6100-4475	01121	RC20GF474J	5905-279-2515
R428	Composition, 120 k Ω $\pm$ 5% 1/2 W	6100-4125	01121	RC20GF124J	5905-192-3981
R429	Composition, 100 Ω $\pm$ 5% 1/2 W	6100-1105	01121	RC20GF101J	5905-190-8889
R430	Composition, 100 k Ω $\pm$ 5% 2 W	6120-4105	01121	RC42GF104J	5905-254-7101
R431	Wire wound, 2.2 Ω $\pm$ 10% 2 W	6760-9229	75042	BWH, 2.2 Ω $\pm$ 10%, 2 W	
R432	Composition, 3 k Ω $\pm$ 5% 1/2 W	6100-2305	01121	RC20GF302J	5905-279-1751
R433	Composition, 15 k Ω $\pm$ 5% 1/2 W	6100-3155	01121	RC20GF153J	5905-279-2616
R434	Composition, 5.6 M Ω $\pm$ 5% 1/2 W	6100-5565	01121	RC20GF565J	5905-279-3838
R435	Composition, 470 k Ω $\pm$ 5% 1/2 W	6100-4475	01121	RC20GF474J	5905-279-2515
R436	Composition, 2.7 M Ω $\pm$ 5% 1/2 W	6100-5275	01121	RC20GF275J	5905-279-1881
R437	Potentiometer, 100 k Ω $\pm$ 20%	6040-1000	01121	FWC, 100 k Ω $\pm$ 20%	5905-958-7949
R438	Composition, 5.6 M Ω $\pm$ 5% 1/2 W	6100-5565	01121	RC20GF565J	5905-279-3838
R501	Wire wound, 0.62 Ω $\pm$ 5% 2 W	6760-8625	75042	BWH, 0.62 Ω $\pm$ 5% 2 W	
R502	Composition, 100 Ω $\pm$ 5% 1/2 W	6100-1105	01121	RC20GF101J	5905-190-8889
R503	Composition, 4.3 k Ω $\pm$ 5% 1/2 W	6100-2435	01121	RC20GF432J	5905-257-0935
R504	Composition, 620 Ω $\pm$ 5% 1/2 W	6100-1625	01121	RC20GF621J	5905-279-1761
R505	Composition, 82 Ω $\pm$ 5% 1/2 W	6100-0825	01121	RC20GF820J	5905-279-1894
R506	Potentiometer, 200 Ω $\pm$ 5% 3 W	1267-0400	24655	1267-0400	
R507	Potentiometer, 500 Ω $\pm$ 10%	6051-1509	02660	2600PC	
R508	Composition, 1.8 k Ω $\pm$ 5% 1/2 W	6100-2185	01121	RC20GF182J	5905-190-8881

TUBES

V301	6AN8	8360-1300	86684	BAN8	5960-082-0039
V302	6AV5GA	8360-2390	82219	6AV5GA	5960-636-0148
V303	5651	8380-5651	49956	5651	5960-617-8685
V304	5965	8380-5965	24446	5965	5960-272-8558
V401	5965	8380-5965	24446	5965	5960-272-8558
V402	5763	8380-5763	79089	5763	5960-188-3915
V403	5763	8380-5763	79089	5763	5960-188-3915
V404	5963	8380-5963	49671	5963	5960-254-1740
V405	5965	8380-5965	24446	5965	5960-272-8558

TRANSISTORS

Q501	Type 40250	8210-1095	12672	40250	
Q502	Type 2N3414	8210-1047	24454	2N3414	
Q503	Type 2N3414	8210-1047	24454	2N3414	
Q504	Type 2N3638	8210-1096	07263	2N3638	
Q505	Type 2N3702	8210-1106	01295	2N3702	

DIODES

CR401	Type 1N989B	6083-1035	80211	1N989B	
CR402	Type 1N191	6082-1008	93916	1N191	5961-296-3360

ELECTRICAL PARTS LIST (cont)

Ref. No.	Description	GR	Fed.	Mfg. Part No.	Fed. Stock No.
		Part No.	Mfg. Code		
CR403	Type 1N4003	6081-1001	79089	1N3253	5961-814-4251
CR501	Type 1N455	6082-1010	07910	1N455	5960-877-8255
CR502	Type 1N645	6082-1016	24446	1N645	5961-944-8222
CR503	Type 1N750	6083-1003	07910	1N750	

RECTIFIERS

RX101	Type 1N3492	6081-1005	94154	1N3492	
RX102	Type 1N3492	6081-1005	94154	1N3492	
RX103	Type 1N3492R	6081-1006	94154	1N3492R	
RX104	Type 1N3492R	6081-1006	94154	1N3492R	
RX201	Type 1N3253	6081-1001	79089	1N3253	5960-814-4251
RX202	Type 1N3255	6081-1003	09213	1N3255	5960-964-5242
RX203	Type 1N3255	6081-1003	09213	1N3255	5960-964-5242
RX204	Type 1N3254	6081-1002	09213	1N3254	5960-082-7347
RX205	Type 1N3254	6081-1002	09213	1N3254	5960-082-7347

MISCELLANEOUS

F101	Fuse, 0.8A, 115 V	5330-1200	71400	MDL, 0.8 Amp	5920-284-6733
F102	Fuse, 0.4A, 230 V	5330-0900	71400	MDL, 0.4 Amp	5920-537-6654
J101	Jack, binding post	0938-3000	24655	0938-3000	
J102	Jack, binding post	0938-3022	24655	0938-3022	
L401	Inductor, 100 μ H	4290-0300	42498	R-33, 100 μ H	
P101	Pilot Lamp, 6.3 V	5600-0700	24454	MAZDA 44	6240-057-2887
PL101	Plug, line input	4240-0702	24655	4240-0702	
S401	Switch, rotary, 5-position	7890-4790	24655	7890-4790	
S402	Switch, part of S401				
S0101	Receptacle, 5-terminal	4230-0700	24655	4230-0700	5935-794-3012
S0102	Cable Assembly, 8-terminal receptacle	1264-0400	24655	1264-0400	
T201	Transformer	0365-4014	24655	0365-4014	

MECHANICAL PARTS LIST

Ref. No.	Description	GR	Fed.	Mfg. Part No.	Fed. Stock No.
		Part No.	Mfg. Code		
Fig. 5-10	Etched-Circuit Assm., Rectifier	1264-2760	24655	1264-2760	
Fig. 5-11	Etched-Circuit Assm., Regulator	1264-2771	24655	1264-2771	
Fig. 5-12	Etched-Circuit Assm., Modulator	1264-2751	24655	1264-2751	
Fig. 5-13	Etched-Circuit Assm., Heater Supply	1264-2731	24655	1264-2731	
Fig. 5-7	Fuse Holder (for F101 and F102).	5650-0100	71400	HKP-H	5920-284-7144
7, Fig. 1-3	Lens, pilot light	5620-0800	72619	95-935	
-	Socket Assembly, pilot light	7510-1930	24655	7510-1930	6210-475-9501
4, Fig. 1-3	Knob Assm., Function switch	5500-5421	24655	5500-5421	
2,3,5,6,	Knob Assembly,	5520-5321	24655	5520-5321	
Fig. 1-3	Modulated Amplitude 1 kHz Duty Ratio 1 kHz Δ Freq. CW Amplitude				
-	Dust-Cover Assembly	4429-0800	24655	4429-0800	
-	End-Frame Assembly (Right)	5310-4084	24655	5310-4084	
-	End-Frame Assembly (Left)	5310-4085	24655	5310-4085	
-	Foot (part of end-frame assembly)	5260-0700	24655	5260-0700	5340-738-6329
-	Screw, foot, No. 10-32, 1/2 (part of end-frame assembly)	7080-1500	24655	10-32x 1/2 in.	

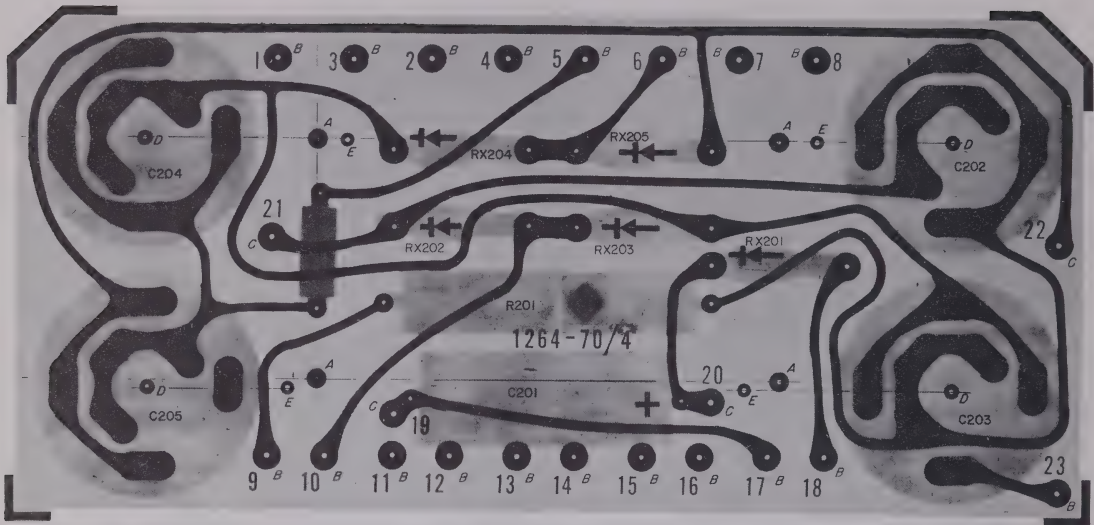


Figure 5-10. Etched-board layout of the 1264-B rectifier-circuit assembly. (P/N 1264-2760).

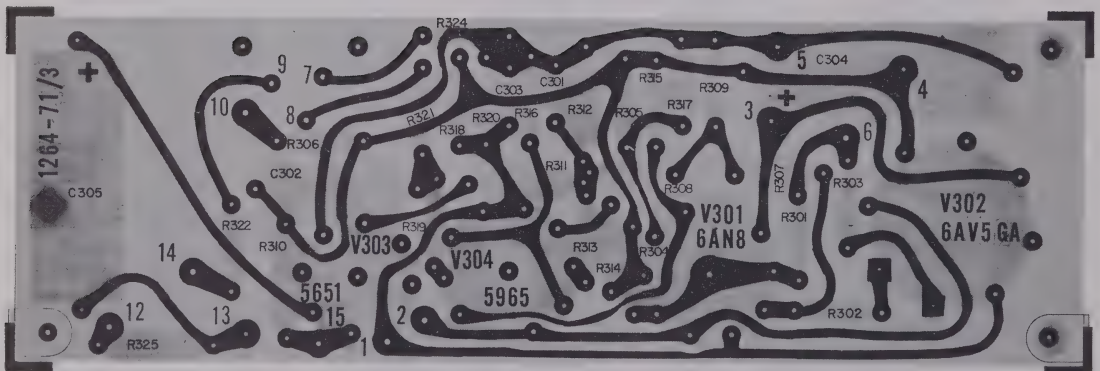


Figure 5-11. Etched-board layout of the 1264-B regulator-circuit assembly. (P/N 1264-2771).

NOTE: The number appearing on the foil side is not the part number.
The dot on the foil at the transistor socket indicates the collector lead.

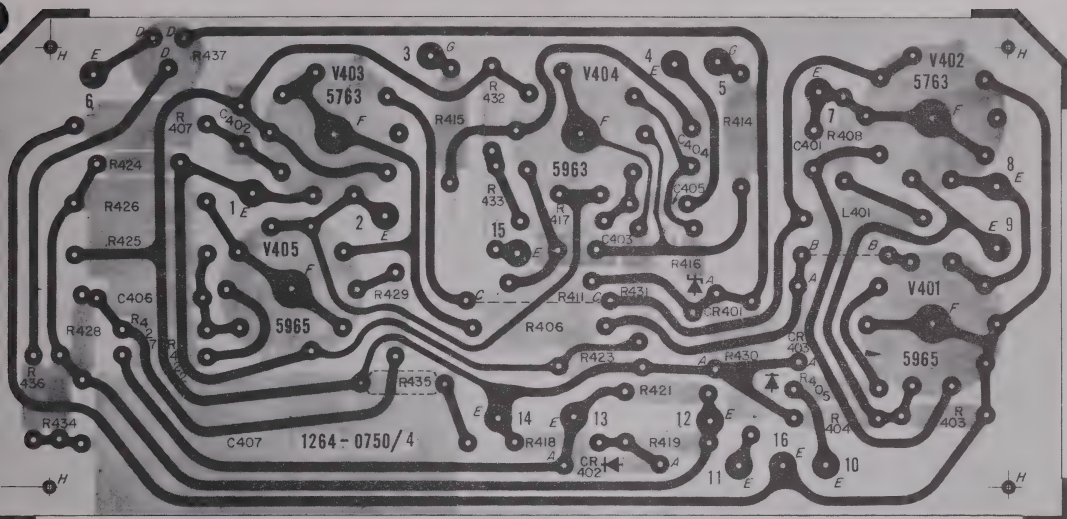


Figure 5-12. Etched-board layout of the 1264-B modulator-circuit assembly. (P/N 1264-2751).

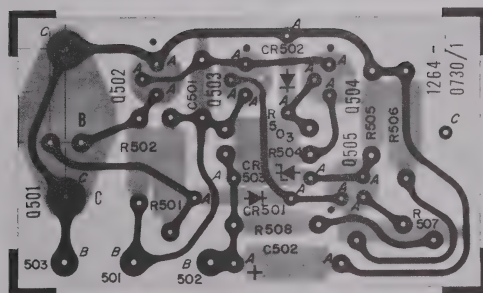


Figure 5-13. Etched-board layout of the 1264-B heater-supply-circuit assembly. (P/N 1264-2731).

NOTE: The number appearing on the foil side is not the part number.
The dot on the foil at the transistor socket indicates the collector lead.

FEDERAL MANUFACTURER'S CODE

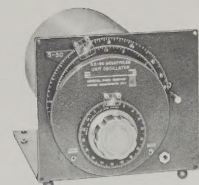
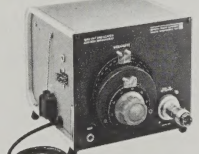
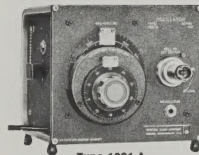
From Federal Supply Code for Manufacturers Cataloging Handbooks H4-1
(Name to Code) and H4-2 (Code to Name) as supplemented through August, 1968.

Code	Manufacturer	Code	Manufacturer	Code	Manufacturer
00192	Jones Mfg. Co, Chicago, Illinois	49671	RCA, New York, N.Y. 10020	80431	Air Filter Corp, Milwaukee, Wisc. 53218
00194	Walsco Electronics Corp, L.A., Calif.	49956	Raytheon Mfg Co, Waltham, Mass. 02154	80583	Hammarlund Co, Inc, New York, N.Y.
00434	Schwarzer Electronics, Westburg, L.I., N.Y.	53021	Sangamo Electric Co, Springfield, Ill. 62705	80740	Beckman Instruments, Inc, Fullerton, Calif.
00566	Aerovox Corp, New Bedford, Mass.	54294	Shallcross Mfg Co, Selma, N.C.	81030	International Instrument, Orange, Conn.
01009	Alden Products Co, Brockton, Mass.	54715	Shure Brothers, Inc, Evanston, Ill.	81073	Grayhill Inc, LaGrange, Ill. 60525
01121	Allen-Bradley Co, Milwaukee, Wisc.	56289	Sprague Electric Co, N. Adams, Mass.	81143	Isolantite Mfg Corp, Stirling, N.J. 07980
01295	Texas Instruments, Inc, Dallas, Texas	59730	Thomas and Betts Co, Elizabeth, N.J. 07207	81349	Military Specifications
02114	Ferroxcube Corp, Sagerties, N.Y. 12477	59875	TRW Inc, (Accessories Div), Cleveland, Ohio	81350	Joint Army-Navy Specifications
02606	Fenwal Lab Inc, Morton Grove, Ill.	60399	Torrington Mfg Co, Torrington, Conn.	81751	Columbus Electronics Corp, Yonkers, N.Y.
02660	Amphenol Electron Corp, Broadview, Ill.	61637	Union Carbide Corp, New York, N.Y. 10017	81831	Filtrcon Co, Flushing, L.I., N.Y. 11354
02768	Festex, Des Plaines, Ill. 60016	61864	United-Carr Fastener Corp, Boston, Mass.	81840	Lodex Inc, Dayton, Ohio 45402
03508	G.E. Semicon Prod, Syracuse, N.Y. 13201	63060	Victoreen Instrument Co, Inc, Cleveland, O.	81860	Carr-Wright Corp, Watertown, Mass.
03636	Grayburne, Yonkers, N.Y. 10701	63743	Ward Leonard Electric Co, Mt. Vernon, N.Y.	82219	Sylvania Elec Prod, Emporium, Penn.
03888	Pyrofilm Resistor Co, Cedar Knolls, N.J.	65083	Westinghouse (Lamp Div), Bloomfield, N.J.	82273	Indiana Pattern & Model Works, LaPort, Ind.
03911	Clairfax Corp, New York, N.Y. 10001	65092	Weston Instruments, Newark, N.J.	82389	Switchcraft Inc, Chicago, Ill. 60630
04009	Airrow-Hart & Hageman, Hartford, Conn.	70485	Atlantic-India Rubber, Chicago, Ill. 60607	82647	Metals & Controls Inc, Attleboro, Mass.
	06106	70563	Ameripete Co, Union City, N.J. 07087	82807	Milwaukee Resistor Co, Milwaukee, Wisc.
04713	Motorola, Phoenix, Ariz. 85008	70903	Belden Mfg Co, Chicago, Ill. 60644	83033	Meissner Mfg, (Maguire Incl) Mt. Carmel, Ill.
05170	Eng'd Electronics, Santa Ana, Calif. 92702	71126	Bronson, Homer D, Co, Beacon Falls, Conn.	83058	Carr Fastener Co, Cambridge, Mass.
05624	Barber-Colman Co, Rockford, Ill. 61101	71294	Canfield, H.O. Co, Clifton Forge, Va. 24422	83186	Victory Engineering, Springfield, N.J. 07081
05820	Wakelief Eng, Inc, Wakefield, Mass. 01880	71400	Bussman (McGraw Edison), St. Louis, Mo.	83361	Bearing Specialty Co, San Francisco, Calif.
07126	Digiltron Co, Pasadena, Calif.	71468	ITT Cannon Elec, L.A., Calif. 90031	83587	Solar Electric Corp, Warren, Penn.
07127	Eagle Signal (E.W. Bliss Co), Baraboo, Wisc.	71590	Centralab, Inc, Milwaukee, Wisc. 53212	83740	Union Carbide Corp, New York, N.Y. 10017
07261	Avnet Corp, Culver City, Calif. 90230	71666	Continental Carbon Co, Inc, New York, N.Y.	83781	National Electronics Inc, Geneva, Ill.
07263	Fairchild Camera, Mountain View, Calif.	71707	Coto Coll Co, Inc, Providence, R.I.	84411	TRW Capacitor Div, Ogallala, Nebr.
07387	Birtcher Corp, No. Los Angeles, Calif.	71744	Chicago Miniature Lamp Works, Chicago, Ill.	84835	Lehigh Metal Prods, Cambridge, Mass. 02140
07595	Amer Semicond, Arlington Hts, Ill. 60004	71823	Cinch Mfg Co, Chicago, Ill. 60624	84971	TA Mfg Corp, Los Angeles, Calif.
07829	Bodine Corp, Bridgeport, Conn. 06605	71875	Dannell Corp, Ltd, Downey, Calif. 90241	86577	Precision Metal Prods, Stoneham, Mass. 02180
07829	Bodine Electric Co, Chicago, Ill. 60618	72136	Electro Motive Mfg Co, Wilmington, Conn.	86684	RCA (Elec. Comp & Dev), Harrison, N.J.
07910	Cont Device Corp, Hawthorne, Calif.	72259	Nytronics Inc, Berkeley Heights, N.J. 07922	86687	REC Corp, New Rochelle, N.Y. 10801
07983	State Labs Inc, N.Y., N.Y. 10003	72619	Dialight Co, Brooklyn, N.Y. 11237	86800	Cont Electronics Corp, Brooklyn, N.Y. 11222
07999	Borg Inst., Delavan, Wisc. 53115	72699	General Instr Corp, Newark, N.J. 07104	88140	Cutler-Hammer Inc, Lincoln, Ill.
08730	Vemaline Prod Co, Franklin Lakes, N.J.	72765	Drake Mfg Co, Chicago, Ill. 60656	88219	Gould Nat. Batteries Inc, Trenton, N.J.
09123	G.E. Semiconductor, Buffalo, N.Y.	72825	Hugh H. Eby Inc, Philadelphia, Penn. 19144	88419	Cornell-Dubilier, Fuquay-Varina, N.C.
09408	Star-Tronics Inc, Georgetown, Mass. 01830	72962	Elastic Stop Nut Corp, Union, N.J. 07083	88627	K & G Mfg Co, New York, N.Y.
09823	Burgess Battery Co, Freeport, Ill.	72982	Erie Technological Products Inc, Erie, Penn.	89482	Holtzer-Cabot Corp, Boston, Mass.
09823	Burndy Corp, Norwalk, Conn. 06852	73138	Beckman Inc, Fullerton, Calif. 92634	89665	United Transformer Co, Chicago, Ill.
11236	C.T.S. of Berne, Inc, Berne, Ind. 46711	73445	Amperex Electronics Co, Hicksville, N.Y.	90201	Mallory Capacitor Co, Indianapolis, Ind.
11599	Chandler Evans Corp, W. Hartford, Conn.	73559	Carling Electric Co, W.Hartford, Conn.	90750	Westinghouse Electric Corp, Boston, Mass.
12040	National Semiconductor, Danbury, Conn.	73690	Elco Resistor Co, New York, N.Y.	90952	Hardware Products Co, Reading, Penn. 19602
12498	Crystallonics, Cambridge, Mass. 02140	73899	JFD Electronics Corp, Brooklyn, N.Y.	91032	Continental Wire Corp, York, Penn. 17405
12672	RCA, Woodbridge, N.J.	74193	Heilmann Electric Co, Trenton, N.J.	91146	ITT (Cannon Electric Inc), Salem, Mass.
12697	Clarostat Mfg Co, Inc, Dover, N.H. 03820	74861	Industrial Condenser Corp, Chicago, Ill.	91293	Johanson Mfg Co, Boonton, N.J. 07005
12954	Dickson Electronics, Scottsdale, Ariz.	74970	E.F. Johnson Co, Waseca, Minn. 55993	91598	Augat Inc, Attleboro, Mass. 02703
13327	Soltron Devices, Tappan, N.Y. 10983	75042	IRC Inc, Philadelphia, Penn. 19108	91598	Chandler Co, Wethersfield, Conn. 06109
14433	ITT Semiconductors, W.Palm Beach, Fla.	75392	Kulka Electric Corp, Mt. Vernon, N.Y.	91637	Dale Electronics Inc, Columbus, Mass.
14655	Cornell-Dublier Electric Co, Newark, N.J.	75481	Lafayette Industrial Electronics, Jamaica, N.Y.	91652	Elco Corp, Willow Grove, Penn.
14674	Corning Glass Works, Corning, N.Y.	75608	Linden and Co, Providence, R.I.	91719	General Instruments, Inc, Dallas, Texas
14936	General Instrument Corp, Hicksville, N.Y.	75915	Littelfuse, Inc, Des Plaines, Ill. 60016	91929	Howeswell Inc, Freeport, Ill.
15238	ITT, Semiconductor Div, Lawrence, Mass.	76005	Lord Mfg Co, Erie, Penn. 16512	92519	Electra Insul Corp, Woodside, L.I., N.Y.
15605	Cutler-Hammer Inc, Milwaukee, Wisc. 53233	76149	Mallory Electric Corp, Detroit, Mich. 48204	92578	E.G.&G., Boston, Mass.
16037	Spruce Pine Mica Co, Spruce Pine, N.C.	76487	James Millen Mfg Co, Malden, Mass. 02148	93332	Sylvania Elect Prods, Inc, Woburn, Mass.
17771	Singer Co, Diehl Div, Somerville, N.J.	76545	Mueller Electric Co, Cleveland, Ohio 44114	93916	Cramer Products Co, New York, N.Y. 10013
19396	Illinois Tool Works, Pakton Div, Chicago, Ill.	76684	National Tube Co, Pittsburg, Penn.	94144	Raytheon Co, Components Div, Quincy, Mass.
19644	LRC Electronics, Horseheads, N.Y.	76854	Oak Mfg Co, Crystal Lake, Ill.	94154	Tung Sol Electric Inc, Newark, N.J.
19701	Electra Mfg Co, Independence, Kansas 67301	77147	Patton MacGyver Co, Providence, R.I.	95076	Garde Mfg Co, Cumberland, R.I.
21335	Fafnir Bearing Co, New Britain, Conn.	77166	Pass-Seymour, Syracuse, N.Y.	95121	Quality Components Inc, St. Mary's, Penn.
22753	UID Electronics Corp, Hollywood, Fla.	77263	Pierce Roberts Rubber Co, Trenton, N.J.	95146	Axco Electronics Mfg Co, Lawrence, Mass.
23342	Avnet Electronics Corp, Franklin Park, Ill.	77339	Positive Lockwasher Co, Newark, N.J.	95238	Continental Connector Corp, Woodside, N.Y.
24446	G.E., Schenectady, N.Y. 12305	77542	Ray-O-Vac Co, Madison, Wisc.	95275	Vitramon Inc, Bridgeport, Conn.
24454	G.E., Electronics Comp, Syracuse, N.Y.	77630	TRW, Electronic Comp, Camden, N.J. 08103	95354	Methode Mfg Co, Chicago, Ill.
24455	G.E. (Lamp Div), Nela Park, Cleveland, Ohio	77638	General Instruments Corp, Brooklyn, N.Y.	95474	General Electric Co, Schenectady, N.Y.
24685	General Radio Co, W. Concord, Mass. 01781	78189	Shakeproof (Ill. Tool Works), Elgin, Ill. 60120	95914	Anaconda Amer Brass Co, Torrington, Conn.
25000	American Zettie, Inc, Cudahy, Wisc. Calif.	78217	Vickers Inc, St. Louis, Mo. 63101	96095	Hi-Q Div, of Aerovox Corp, Orlean, N.Y.
28520	Hayman Mfg Co, Kenilworth, N.J.	78488	Stackpole Carbon Co, St. Marys, Penn.	96214	Texas Instruments Inc, Dallas, Texas 75209
28959	Hoffman Electronics Corp, El Monte, Calif.	78553	Tinnerman Products, Inc, Cleveland, Ohio	96256	Thorderson-Melsner, Mt. Carmel, Ill.
30874	I.B.M., Armonk, New York	79089	RCA, Rec Tube & Semicond, Harrison, N.J.	96341	Microwave Associates Inc, Burlington, Mass.
32001	Jensen Mfg Co, Chicago, Ill. 60638	79725	Wiremold Co, Hartford, Conn. 06110	96791	Amphenol Corp, Jonesville, Wisc. 53545
33173	G.E. Comp, Owensboro, Ky. 42301	79963	Zierlick Mfg Co, New Rochelle, N.Y.	96906	Military Standards
35929	Constanta Co, Mount 19, Que.	80030	Prestole Fastener, Toledo, Ohio	98291	Sealecitor Corp, Mamaroneck, N.Y. 10544
37942	P.R. Mallory & Co Inc, Indianapolis, Ind.	80048	Vickers Inc, St. Louis, Mo. 63101	98474	Comar Inc, Burlington, Calif.
38443	Marlin-Rockwell Corp, Jamestown, N.Y.	80131	Electronic Industries Assoc, Washington, D.C.	98821	North Hills Electronics Inc, Glen Cove, N.Y.
40931	Howeswell Inc, Minneapolis, Minn. 55408	80183	Sprague Products Co, No. Adams, Mass.	99180	Transitron Electronics Corp, Melrose, Mass.
42190	Muter Co, Chicago, Ill. 60638	80211	Motorola Inc, Franklin Park, Ill. 60131	99313	Varian, Palo Alto, Calif. 94303
42498	National Co, Inc, Melrose, Mass. 02176	80258	Standard Oil Co, Lafayette, Ind.	99378	Atlee Corp, Winchester, Mass. 01890
43991	Norma-Hoffman, Stanford, Conn. 06904	80294	Bourns Inc, Riverside, Calif. 92506	99800	Delevan Electronics Corp, E. Aurora, N.Y.

HF, VHF, UHF, Microwave Oscillators

FEDERAL MANUFACTURER'S CODE
From Federal Supply Code for Manufacturers Cataloging Handbooks H4-1
(Name to Code) and H4-2 (Code to Name) as supplemented through August, 1968.

Code	Manufacturer	Code	Manufacturer	Code	Manufacturer
00192	Jones Mfg. Co., Chicago, Illinois	49671	RCA, New York, N.Y. 10020	80431	Air Filter Corp., Milwaukee, Wisc. 53218
00194	Walco Electronics Corp., L.A., Calif.	49556	Raytheon Mfg Co., Waltham, Mass. 02154	80582	Hammamulund Co., Inc., New York, N.Y.
00434	Schweber Electronics, Westburg, Ill., N.Y.	50021	Sanamo Electric Co., Springfield, Ill. 62105	80740	Beckman Instruments, Inc., Fullerton, Calif.
00586	Aerovox Corp., New Bedford, Mass.	54294	Shalcross Mfg Co., Selma, N.C.	81030	International Instrument, Orange, Conn.
01009	Alden Products Co., Brockton, Mass.	54715	Shure Brothers, Inc., Evanston, Ill.	81073	Grayhill Inc., LaGrange, Ill. 60525
01121	Allen-Bradley, Co., Milwaukee, Wisc.	55289	Sprague Electric Co., N. Adams, Mass.	81143	Isolantite Mfg Corp., Stilline, N.J. 07980
01295	Texas Instruments, Inc., Dallas, Texas	59730	Thomas and Betts Co., Elizabeth, N.J. 07207	81349	Military Specifications
02114	Ferroxcube Corp., Saugerties, N.Y. 12477	59875	TRW Inc., (Accessories Div.), Cleveland, Ohio	81350	Joint Army-Navy Specifications
02606	Fennel Lab Inc., Morton Grove, Ill.	60389	Torrington Mfg Co., Torrington, Conn.	81751	Columbus Electronics Corp., Yonkers, N.Y.
02660	Amphenol Electron Corp., Broadview, Ill.	61637	Union Carbide Corp., New York, N.Y. 10017	81831	Filtron Co., Flushing, L.I., N.Y. 11354
02768	Fattas, Des Plaines, Ill. 60016	61864	United-Carr Fastener Corp., Boston, Mass.	81840	Ladex Inc., Dayton, Ohio 45402
03508	G.E. Semicon Prod., Syracuse, N.Y. 13201	63060	Victoreen Instrument Co., Inc., Cleveland, O.	82219	Barry-Wright Corp., Watertown, Mass.
03636	Grayburne, Yonkers, N.Y. 10701	63743	Ward Leonard Electric Co., Mt. Vernon, N.Y.	82273	Sylvania Elec. Prod., Emporium, Penn.
03888	Pyrofilm, Inc., Cedar Knolls, N.J.	65083	Westinghouse (Lamp Div.), Bloomfield, N.J.	82389	Switchcraft Inc., Chicago, Ill. 60630
03911	Clairco Corp., New York, N.Y. 10001	65092	Weston Instruments, Newark, N.J.	82647	Metals & Controls Inc., Attleboro, Mass.
04009	Arrow-Hart & Hageman, Hartford, Conn.	70563	Atlantic-India Rubber, Chicago, Ill. 60607	82807	Milwaukee Resistor Co., Milwaukee, Wisc.
	06106	70563	Amstar Co., Union City, N.J. 07087	83781	Melnsner Mfg. (Maguire Ind.) Mt. Carmel, Ill.
04713	Motorola, Phoenix, Ariz. 85008	70903	Baldon Mfg Co., Chicago, Ill. 60644	83058	Carr Fastener Co., Cambridge, Mass.
05170	Eng'd Electronics, Santa Ana, Calif. 92702	71126	Bronson, Homer O. Co., Beacon Falls, Conn.	83186	Victory Engineering, Springfield, N.J. 07081
05624	Barber-Colman Co., Rockford, Ill. 61101	71254	Canfield, H.O. Co., Clifton Forge, Va. 24422	83381	Bearing Specialty Co., San Francisco, Calif.
05820	Wackerfield Eng. Inc., Wackerfield, Mass. 01880	71400	Bussman (McCraw Edison), St. Louis, Mo.	83587	Solar Electric Corp., Warren, Penn.
07126	Digiltron Co., Pasadena, Calif.	71468	ITT Cannon Elec., L.A., Calif. 90031	83740	Union Carbide Corp., New York, N.Y. 10017
07127	Eagle Signal (E.W. Bliss Co.), Baraboo, Wisc.	71590	Centralab, Inc., Milwaukee, Wisc. 53212	83781	Continental Carbon Co., Inc., New York, N.Y.
07261	Avnet Corp., Culver City, Calif. 90230	71666	ITT Cannon Elec., L.A., Calif. 90031	84411	TRW Capacitor Div., Ogalala, Nebr.
07263	Fairchild Camera, Mountain View, Calif.	71707	Coto Coll Co. Inc., Providence, R.I.	84835	Lehigh Metal Prods., Cambridge, Mass. 02140
07387	Birtcher Corp., No. Los Angeles, Calif.	71744	Chicago Miniature Lamp Works, Chicago, Ill.	84971	Ta Mfg Corp., Los Angeles, Calif.
07595	Amer Samsco, Arlington Hts. Ill. 60004	71785	Cinch Mfg Co., Chicago, Ill. 60624	85577	Precision Metal Prods., Stoneham, Mass. 02180
07828	Bodine Corp., Bridgeport, Conn. 06605	71823	Daniell Corp., Ltd., Downey, Calif. 90241	86684	RCA (Elect. Comp. & Dev.), Harrison, N.J.
07829	Bodine Electric Co., Chicago, Ill. 60618	72124	Electro Motive Mfg Co., Wilmington, Conn.	86687	REC Corp., New Rochelle, N.Y. 10801
07910	Conti Device Corp., Hawthorne, Calif.	72354	Nytronics Inc., Berkeley Heights, N.J. 07922	86800	Cont Electronics Corp., Brooklyn, N.Y. 11222
07983	Sata Labs Inc., N.Y., N.Y. 10003	72619	Dialight Co., Brooklyn, N.Y. 11237	88140	Custer-Hammer Inc., Lincoln, Ill.
07999	Borg Inst., Delavan, Wisc. 53115	72699	General Instr. Corp., Newark, N.J. 07104	88219	Could Nat. Batteries Inc., Trenton, N.J.
08730	Vernafine Prod Co., Franklin Lakes, N.J.	72765	Drake Mfg Co., Chicago, Ill. 60656	88419	Cornell-Dubilier, Fuquay-Varina, N.C.
09213	G.E. Semiconductor, Buffalo, N.Y.	72825	Hugh H. Eby Inc., Philadelphia, Penn. 19144	88627	K & G Mfg Co., New York, N.Y.
09408	Star-Tronics Inc., Georgetown, Mass. 01830	72962	Elastic Stop Nut Corp., Union, N.J. 07093	89482	Holtzer-Cabot Corp., Boston, Mass.
09823	Burgess Battery Co., Freeport, Ill.	72982	Erie Technological Products Inc., Erie, Penn.	89665	United Transformer Co., Chicago, Ill.
09922	Burndy Corp., Norwalk, Conn. 06852	73138	Backman Inc., Fullerton, Calif. 92634	90201	Mallory Capacitor Co., Indianapolis, Ind.
11236	C.T.S. of Barne, Inc., Barne, Ind. 46711	73445	Amperex Electronics Co., Hicksville, N.Y.	90750	Westinghouse Electric Corp., Boston, Mass.
11599	Chandler Evans Corp., W. Hartford, Conn.	73559	Carling Electric Co., W. Hartford, Conn.	90952	Hardware Products Co., Reading, Penn. 19602
12040	National Semiconductor, Danbury, Conn.	73690	Elco Resistor Co., New York, N.Y.	91032	Continental Wire Corp., York, Penn. 17405
12498	Crystalonics, Cambridge, Mass. 02140	73899	JFD Electronics Corp., Brooklyn, N.Y.	91146	ITT (Cannon Electric Inc.), Salem, Mass.
12672	RCA, Woodbridge, N.J.	74193	Helmenann Electric Co., Trenton, N.J.	91293	Johanson Mfg Co., Broomfield, N.J. 07009
12697	Clarostrat Mfg Co., Inc., Dover, N.H. 03820	74861	Industrial Condenser Corp., Chicago, Ill.	91508	Chandler Co., Wetherfield, Conn. 06105
12954	Dickson Electronics, Scottsdale, Ariz.	74970	E.F. Johnson Co., Waseca, Minn. 56093	91637	Dale Electronics Inc., Columbus, Nebr.
13327	Sollitron Devices, Tappan, N.Y. 10983	75042	IRC Inc., Philadelphia, Penn. 19108	91662	Elco Corp., Willow Grove, Penn.
14433	ITT Semiconductor, W. Palm Beach, Fla.	75382	Kulka Electric Corp., Mt. Vernon, N.Y.	91719	General Instruments, Inc., Dallas, Texas
14468	Cornell-Dubilier Electric Co., Franklin, N.J.	75491	Lafayette Industrial Electric Corp., Jamaica, N.Y.	91929	Homevill Inc., Freeport, Ill.
14674	Corning Glass Works, Corning, N.Y.	75608	Linden and Co., Providence, R.I.	92519	Lord Mfg Co., Erie, Penn. 16511
14936	General Instrument Corp., Hicksville, N.Y.	75915	Littelfuse Inc., Oak Plains, Ill. 60016	92678	E.G. & G., Boston, Mass.
15208	ITT Semiconductor Div., Lawrence, Mass.	76149	Mallory Electric Corp., Detroit, Mich. 48204	93332	Sylvania Elect. Prods. Inc., Woburn, Mass.
15605	Cutter-Hammer Inc., Milwaukee, Wisc. 53233	76545	James Millen Mfg Co., Malden, Mass. 02148	93916	Cramer Products Co., New York, N.Y. 10013
16037	Spruce Pine Mfg Co., Spruce Pine, N.C.	76487	National Tube Co., Pittsburg, Penn.	94144	Raytheon Co., Components Div., Quincy, Mass.
16771	Singer Co., Dahl Div., Springfield, Ill. 61114	76884	Oak Mfg Co., Crystal Lake, Ill.	94154	Tung Sol Electric Inc., Newark, N.J.
19286	Illinois Tool Works, Faxon Div., Chicago, Ill.	76884	Patton MacGyver Co., Providence, R.I.	95076	Gardco Mfg., Cumberland, R.I.
19644	LRC Electronics, Honesdale, N.Y.	77147	Pass-Seymour, Syracuse, N.Y.	95121	Quality Components Inc., St. Mary's, Penn.
19701	Electra Mfg Co., Independence, Mo.	77263	Pierce Roberts Rubber Co., Trenton, N.J.	95146	Alco Electronics Mfg Co., Lawrence, Mass.
20235	Rafinr Bearing Co., New Britain, Conn.	77339	Positive Lockmaster Corp., Newark, N.J.	95238	Continental Connector Corp., Woodside, N.Y.
22354	UID Electronics Corp., Hollywood, Fla.	77842	Ray-O-Vac Co., Madison, Wisc.	95275	Vitramon, Inc., Bridgeport, Conn.
22792	Avnet Electronics Corp., Franklin Park, Ill.	77630	TRW, Electronic Comp., Camden, N.J. 08103	95354	Method Mfg Co., Chicago, Ill.
24446	G.E. Schenectady, N.Y. 12305	77638	General Instruments Corp., Brooklyn, N.Y.	95412	General Electric Co., Schenectady, N.Y.
24454	G.E., Electronics Corp., Syracuse, N.Y.	78189	Shakeproof (Ill.) Tool Works), Elgin, Ill. 60120	95794	Anacoda Amer Brass Co., Torrington, Conn.
24655	G.E. (Lamp Div.), W. Concord, Mass. 01781	78277	Sigma Instruments Inc., S. Braintree, Mass.	96095	H-I-D. Div. of, Aerovox Corp., Olean, N.Y.
26806	American Zettist Inc., Costa Mesa, Calif.	78553	Tinnerman Products, Inc., Cleveland, Ohio	96214	Texas Instruments Inc., Dallas, Texas 75209
28520	Hayman Mfg Co., Kailsworth, N.J.	79089	RCA, Rac Tube & Semiconductor, Harrison, N.J.	96241	Thorderson-Melnsner, Mt. Carmel, Ill.
28959	Hoffman Electronics Corp., El Monte, Calif.	79239	Wiremaid Co., Hartford, Conn. 06110	96341	Microwave Associates Inc., Burlington, Mass.
30874	I.B.M., Armonk, New York	79963	Zierlick Mfg Co., New Rochelle, N.Y.	96791	Amphenol Corp., Jonestown, Wisc. 53545
32001	Jensen Mfg Co., Chicago, Ill. 60638	80030	Prestole Fastener, Toledo, Ohio	96906	Military Standards
32172	G.E. Comp. Ovensboro, Ky. 42301	80131	Electronic Industries Assoc., Washington, D.C.	98291	Selsator Corp., Mamaroneck, N.Y. 10544
35929	Constanta Co., Mont. 19, Que.	80183	Sprague Products Co., No. Adams, Mass.	98474	Compar Inc., Burlington, Calif.
37942	P.R. Mallory & Co. Inc., Indianapolis, Ind.	80258	Standard Oil Co., Lafayette, Ind.	98821	North Hills Electronics Inc., Glen Cove, N.Y.
38443	Marlin-Rockwell Corp., Jamestown, N.Y.	80294	Bourne Inc., Riverside, Calif. 92506	99180	Transitron Electronics Corp., Melrose, Mass.
40931	Howell Inc., Minneapolis, Minn. 55408			99211	Varian, Palo Alto, Calif. 94303
42190	Muser Co., Chicago, Ill. 60638			99378	Atlee Corp., Winchester, Mass. 01890
42498	National Co., Inc., Melrose, Mass. 02176			99508	Delevan Electronics Corp., E. Aurora, N.Y.
43991	Norma-Hoffman, Stamford, Conn. 06904				

Type 1211-C
Unit OscillatorType 1215-C
Unit OscillatorType 1363
VHF OscillatorType 1362
UHF OscillatorType 1361-A
UHF OscillatorType 1218-B
Unit Oscillator

Type 1218-BV Lockable Oscillator

Catalog Number	Frequency	Tuned Circuit	Calibration Accuracy	Warmup Frequency Drift (Typical)	Use with Power Supply
1211-9703	0.5 to 50 MHz	Variable L and C	±2%	0.4%	1267 1269 1263
1215-9703	50 to 250 MHz	Semi-Butterfly	±1%	0.2%	1267 1269 1264 1263
1363-9701	56 to 500 MHz	Variable L and C	±2%	0.8%	1267 1269 1264
1362-9701	220 to 920 MHz	Butterfly	±1%	0.2%	1267 1269 1264 1263
1361-9701	450 to 1050 MHz	Butterfly	±1%	0.2%	1267 1269 1264 1263
1218-9702 1218-9724	900 to 2000 MHz	Adjustable Lines	±1%	0.1%	1267 1269 1264 1263

GENERAL RADIO

WEST CONCORD, MASSACHUSETTS 01781
617 369-4400

SALES AND SERVICE

ATLANTA	404 633-6183	DENVER	303 447-9225	ROCHESTER	315 394-2037
*BOSTON	617 646-0550	DETROIT	313 261-1750	PHILADELPHIA	215 646-8030
BRIDGEPORT	203 377-0165	GREENSBORO	919 288-4316	SAN DIEGO	714 232-2727
*CHICAGO	312 992-0800	HOUSTON	713 622-7007	*SAN FRANCISCO	415 948-8233
*CLEVELAND	216 886-0150	HUNTSVILLE	800 241-5122	SEATTLE	206 644-7545
*COCA BEACH	800 241-5122	INDIANAPOLIS	317 636-3907	SYRACUSE	315 454-9323
*DALLAS	214 637-2240	*LOS ANGELES	213 469-6201	*WASHINGTON	BALTIMORE
DAYTON	513 434-6979	*NEW YORK	(NY) 212 964-2722		301 946-1600
			(NJ) 201 943-3140		

INTERNATIONAL DIVISION

WEST CONCORD, MASSACHUSETTS 01781, USA

*GENERAL RADIO COMPANY (OVERSEAS)

Helensstrasse 3, CH-8034, Zurich 34, Switzerland

AUSTRALIA Warrington Frank Industries Sydney, Melbourne, Brisbane, Adelaide	JAPAN Mitsubishi Electric Co., Ltd. Tokyo, Osaka KOREA M.C. International Seoul, Korea MALAYSIA AND SINGAPORE Yong Sang Company Kuala Lumpur, Malaysia	REPUBLIC OF SOUTH AFRICA G. H. Langer & Co., Ltd. Johannesburg SOUTH AND CENTRAL AMERICA Ad. Aurelia, Inc. New York	FRANCE Ets Radiohron Paris, Lyon Radiohron Corporation New York	NORWAY Osten A. Ring A/S Oslo	UNITED KINGDOM *General Radio Company Ltd., London Bourne Eng. Buckinghamshire
CANADA *General Radio Canada Limited Montreal, Ottawa	MEXICO Fradin S.A. Mexico City NEW ZEALAND W. & M. Lean Limited Auckland	TAIWAN Henghuan Scientific Co., Ltd. Taipei	GERMANY Grupe-Radiogrup S. A. Bruxelles	SWEDEN Penna Johan Lagerstrom KB Solna	YUGOSLAVIA Sanford de Brun Vukovar, Croatia
DEMOCRATIC REPUBLIC OF THE CONGO Ndupho-Desco Co., Inc. New York	INDIA Motwane Private Limited Bombay, Calcutta, Lucknow, Kanpur, New Delhi, Rangoon, Madras	THAILAND G. Simon Radio Company Ltd. Bangkok	DENMARK Sensler & Mathiasen København Ø	NETHERLANDS Gronveld Group Verkoop Amsterdam	
PAKISTAN Pakistan Corporation Karachi	PHILIPPINES T. North & Company Manila, Rizal	TURKEY Mevag Engineering, Trading and Industrial Corporation Istanbul	FINLAND Intco Oy Helsinki		

* Repair services are available at these offices.

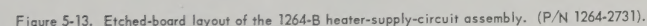
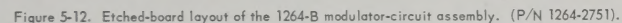


Figure 5-14. Schematic diagram of the 1264-B Modulating Power Supply.

GENERAL RADIO
WEST CONCORD, MASSACHUSETTS 01781